

Advancing Arizona

Developing minds, ideas, solutions

Technology and Research Initiative Fund Fiscal Year 2014 Annual Report

September 1, 2014

As required by A.R.S. §15-1648 (D)

This page intentionally left blank.



ARIZONA BOARD OF REGENTS TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF) ANNUAL REPORT

For the Fiscal Year Ended June 30, 2014

TABLE OF CONTENTS

TRIF Executive Summary	1
------------------------------	---

TRIF Program Summaries

Arizona State University	3
Northern Arizona University	13
The University of Arizona	23
Arizona Board of Regents System Office	35

System Summary: TRIF Metrics and Financials

Arizona University System	45
Arizona State University	49
Northern Arizona University	55
The University of Arizona	61
Arizona Board of Regents System Office	67

This page intentionally left blank.



TRIF Executive Summary

This page intentionally left blank.



Technology and Research Initiative Fund (TRIF)

BACKGROUND

- ▶ Proposition 301 increased the state's sales tax to be dedicated to K-12, the community colleges, and Arizona's public universities. Collection of the tax began on June 1, 2001, and will continue through June 30, 2021, under current law.
- ▶ Using Proposition 301 revenue, A.R.S. §15-1648 establishes the Technology and Research Initiative Fund (TRIF) in the State Treasurer's Office and gives the Arizona Board of Regents (ABOR) the responsibility to administer the fund.
- ▶ TRIF monies are continuously appropriated to ABOR and do not lapse at the end of the fiscal year.

TRIF BUDGET

- ▶ The Arizona Board of Regents approves the TRIF budgets and business plans in 5-year cycles. The FY 2012-2016 business plan was approved by the Board in April 2011 and revised in August 2012, based on an updated sales tax forecast from the JLBC. These business plans and brochures are available on the ABOR web site at: www.azregents.edu.
- ▶ In FY 2013-14, TRIF received approximately \$66.7 million in revenue. The projected revenue for FY 2012-2016 is approximately \$382.6 million. Total TRIF revenue received to date since the inception of the program in June 2001 is \$755 million.
- ▶ The TRIF statute includes a 20 percent limitation on use of TRIF funds for capital projects expenditures.

(continued)

TRIF INITIATIVES

- ▶ Pursuant to A.R.S. §15-1648(C), TRIF monies will be used to support initiatives and projects that meet one or more of the following criteria:
 - Promote university research, development, and technology transfer related to the knowledge-based global economy
 - Expand access to baccalaureate or post-baccalaureate education for time-bound and place-bound students
 - Implement final recommendations from the Governor's Task Force on Higher Education and/or the Arizona Partnership for the New Economy
 - Develop programs that will prepare students to contribute in high technology industries located in Arizona
- ▶ Priority will be given to proposals that involve collaboration between and among the universities and/or collaboration with private industry or public sector agencies.
- ▶ The above criteria are included in ABOR Policy 3-412, along with formats for submission of proposals and other guidelines.
- ▶ The universities' investments of TRIF funds in FY 2012-2016 will be limited to and focused in four research areas and one workforce development area:

Research investment areas:

Improving Health—ASU, NAU, UA

Water, Environmental, and Energy Solutions—ASU, NAU, UA

National Security Systems—ASU

Space Exploration and Optical Solutions—UA

Workforce development investment areas:

Higher Education Access for Workforce Development—NAU, UA

TRIF REPORTING

- ▶ A.R.S. §15-1648(D) requires the Board to submit to the Governor and the Legislature by September 1 of each year a report of prior year TRIF expenditures.
- ▶ The FY 2014 TRIF report, along with previous reports, is available on the ABOR web site.

July 30, 2014



ASU ARIZONA STATE
UNIVERSITY

This page intentionally left blank.



Technology and Research Initiative Funds (TRIF) invested in advancing research, entrepreneurship and economic **development at Arizona State University (ASU) help fuel innovative solutions. These solutions are carried** forward to the marketplace where they have tangible, positive impacts on people's lives and on our economy. TRIF propels the university knowledge enterprise forward, accelerating scientific and technological breakthroughs. It establishes Arizona at the vanguard of research accomplishments, while also generating new ideas that create near- and long-term return on investment.

During the TRIF cycle of FY12 through FY16, ASU is investing in three key focus areas.

- **Improving Health** encompasses use-inspired, collaborative research that advances human health and quality of life.
- **National Security Systems** addresses critical research and technology for the security, defense and aerospace sectors.
- **Water, Environmental and Energy Solutions** integrates research efforts that create solutions to the challenges posed by urbanization and the increasing demands for energy, water and clean air.

ASU is committed to providing high-value returns on TRIF investments for Arizona citizens. We are pleased to present the accomplishments enabled by TRIF in FY14. These successes include bringing new products and solutions to the marketplace, training students to fulfill the high-tech employment needs of the Arizona and national economies, and leveraging TRIF-supported research to secure new investments and to attract corporate partnerships.

"We strategically invest TRIF in research and technology that directly translates to improvements in people's lives and our local and national economies. TRIF has enabled the development of life-saving vaccines, supported Arizona's defense and aerospace sectors, and helped establish our state as a leader in alternative fuels research. These endeavors not only enhance the quality of education of our students but also elevate the prestige of Arizona as a leader in economic development and entrepreneurship."

– *Sethuraman Panchanathan, Senior Vice President of Knowledge Enterprise Development*



"TRIF investments have positioned the Biodesign Institute uniquely as a cornerstone of ASU's strategy to propel the university into the top tier of the world's premier research institutions. The State of Arizona has received significant return on its investment in Biodesign, generous support that served as a key catalyst to advance our mission of entrepreneurial-based research that improves human health and the health and security of our planet."

– *Raymond DuBois, director of the Biodesign Institute*



IMPROVING HEALTH

The **Improving Health** focus area continues to meet the complex and critical challenges of advancing health and health care. This focus area fuses biomedicine, engineering and computing through innovative approaches in partnership with world-class institutes like Mayo Clinic. The result is cutting-edge research, embarked on by researchers and vetted by practicing doctors, that is changing the health care landscape.

Programs supported in the Improving Health focus area and associated goals:

- The **Biodesign Institute** addresses today's critical global challenges in health care, sustainability and security by developing solutions inspired from natural systems and translating those solutions into commercially viable products and clinical practices.
- The **Complex Adaptive Systems (CAS)** initiative integrates diverse disciplines from across the campus and the globe to create entirely new technologies and novel solutions to present and future challenges. CAS offers unprecedented opportunities to "de-convolute" the complexity of challenges in the economy, health care and the energy crisis.
- The **Advanced Computing Center (A2C2)** provides a unique, high-performance computing resource to the campus and the community that allows ASU researchers, industry partners and community leaders to collect, manage and analyze vast and complex data sets in order to elucidate health care strategies and outcomes.
- The **Center for Games and Impact** partners with scientists and game developers to harness the power of gaming platforms, theory and technology for application in health, economics and sustainability. The Innovation Lab at the center develops gaming platforms, impact guides, and research and development services to provide innovative solutions that benefit K-12 schools, community organizations, corporate responsibility efforts and the general public with a focus on issues related to health and learning.
- The **Isotope Metallomics** initiative advances research leading to the identification of new biological indicators (biomarkers) for breast and prostate cancers, osteoporosis and other diseases. The field of study is still developing and the initiative is at the forefront of biomedical research and practice. Identified metallomic biomarkers will lead to earlier disease detection and more targeted treatment.

"TRIF allows us to build a transformative vision that moves us from a product focused on a specific output to the creation of an impact-focused vision and technical framework. We are now designing, implementing and researching new learning models that are being tested at ASU to transform higher education learning at middle schools across the country and globally."

– Sasha Barab, director of the Center for Games and Impact





Summary of Accomplishments

Accomplishments in the **Improving Health** focus area include leveraging TRIF investments to secure significant external awards, establishing ASU as a leader in biosignature-based health care research and infrastructure, and advancing societal impact by bringing health technologies to the marketplace.

Results - Impact

- **Researchers at the Biodesign Institute secured \$26 million in new funding to develop a diagnostic test to rapidly measure an individual's level of radiation absorption.** The Biodesign research portfolio also includes a radical new look at the complexities of the gut microbiome and its association with autism; developing a vaccine to confer nicotine immunity; and unlocking gene sequences for amino acids, which will provide a wealth of information relevant to diseases such as cancer, diabetes and neurological disorders like Alzheimer's disease.
- **HealthTell, Inc. secured \$4 million in new funding to help commercialize a test for lung, breast, prostate and colorectal cancer.** HealthTell, Inc. is a biotech spinout company based on technology developed at the Biodesign Institute.
- **CAS launched the National Biomarker Development Alliance (NBDA), the first organization of its kind.** A deep understanding of biomarkers will allow diseases or potential diseases to be identified earlier. This in turn enables medical treatment to be tailored to an individual with unprecedented precision.
- **The high-performance computing capabilities of A2C2 enabled analysis of massive data sets,** including those associated with health and medical research. In addition, the strong bioinformatics research and education partnership between ASU and Mayo Clinic has been made possible by the advanced hardware and software capacity available through A2C2.
- **The Center for Games and Impact has directly impacted more than 500 educators and 1,500 middle school students through immersive 3D games focused on health and social impact.** In addition, the center is a partner in Intel She Will Connect, which enables technology access and education to women in Africa, providing significant positive impacts to their quality of life in terms of digital literacy, health, finances and education.
- **The Isotope Metallomics initiative carried out pilot research, which successfully showed that calcium concentrations can be used as a biomarker.** This discovery has the potential to improve clinical care of cancer and osteoporosis patients.

"TRIF makes it possible to support innovative transdisciplinary projects at a critical stage. Since our methods are alien to the medical community, and our applications alien to the geoscience community, funding is a challenge. This will remain so until we generate enough biomedical data to overcome skepticism in the medical community. Thanks to the TRIF investment, we have nearly crossed the bridge."

– Ariel Anbar, director of Isotope Metallomics initiative





NATIONAL SECURITY SYSTEMS

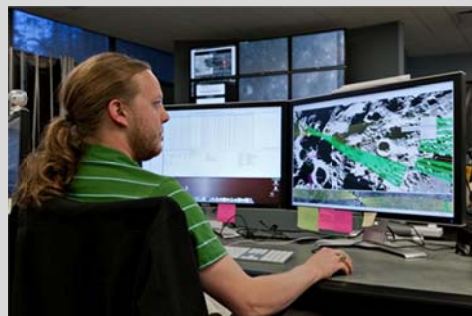
The portfolio of programs in the **National Security Systems** focus area is playing a key role in making Arizona a premier location for companies in the aerospace and defense sectors. This focus area builds on Arizona's established defense industry and positions the state for an unprecedented level of partnership between the university, industry and government.

Programs supported in the National Security Systems focus area and associated goals:

- The ***Security and Defense Systems Initiative*** (SDSI) engages faculty and researchers across the entire university in both on- and off-campus facilities. Expertise and resources are leveraged to broaden existing efforts, improve connections and collaborations with government and industry, and involve ASU students in research projects and public service.
- The ***Space Technology and Science Initiative*** (NewSpace) leverages expertise in space-related science, technology and operations to strengthen mutual interactions with aerospace companies. A particular focus is on developing partnerships with emerging and entrepreneurial companies in Arizona and the Southwest, where private commercial spaceports and rocket factories are increasingly becoming an integral part of the NewSpace landscape.
- The ***Flexible Electronics and Display Center*** (FEDC) operates as a public-private partnership that has established itself as a global leader in flexible electronics manufacturing, including materials research and development and supply chain development. The center has created a powerful innovation infrastructure to advance full-color, video-rate and flexible display technology.

"The NewSpace initiative is developing partnerships that will enable faculty and researchers to tap into new private and governmental funding streams for cutting-edge space-related research, and to enhance the pipeline of Arizona students transitioning into skilled aerospace-related internships and careers."

– Jim Bell, director of the NewSpace initiative





Summary of Accomplishments

The **National Security Systems** focus area has created a university research initiative that partners with companies in the highly competitive security, defense and aerospace sectors and that integrates new technologies into practical systems. Creating such an initiative is key to realizing the economic growth that is possible for Arizona in this industry. Since the inception of this focus area, ASU has created significant new research and economic opportunity related to security and defense and is now expanding into aerospace.

Results – Impact

- **SDSI, in collaboration with the Decision Theater and other ASU initiatives and schools, secured a prestigious award of \$20 million from the National Geospatial-Intelligence Agency to launch a research partnership.** The Foresight initiative will develop decision-making capabilities in the context of national security risks associated with severe weather events and their potential effects on resources and political unrest and instability.
- **SDSI efforts were instrumental in securing Department of Defense (DoD) funding for a Pracademic Center of Excellence (PACE) in Technology Transfer (T2).** The center is the first of its kind and adapts ASU's proven Furnace technology accelerator system for DoD laboratories. PACE/T2 is already being implemented at three DoD laboratories and has created 50 new potential ventures.
- **The NewSpace initiative secured funding from NASA's Jet Propulsion Laboratory to oversee the development of a CubeSat communications ground station on the Tempe campus.** This ground station will enable and leverage significant student, staff and faculty involvement in future small satellite proposals and interactions with NewSpace companies and government labs.
- **FEDC continues to manufacture breakthrough technology that is attracting industry partners and catalyzing new research and marketplace opportunities.** Achievements include maintaining the world record for largest flexible color organic light emitting display (OLED) with a new display that measures 14.7 diagonal inches. In addition, a collaboration has been established with Fraunhofer, the largest contract research and development organization in Europe; and ASU is one of a select group that has been invited to propose a new National Science Foundation Engineering Research Center focused on autonomous electronics systems.

"The national security challenges facing our nation today require solutions at the intersections of disciplines. TRIF investment enables and amplifies the development of timely solutions to these challenges leveraging ASU's leadership in transdisciplinary research." – Nadya Bliss, co-director of SDSI and Assistant Vice President of Research Strategy





WATER, ENVIRONMENTAL AND ENERGY SOLUTIONS

The **Water, Environmental and Energy Solutions** focus area is addressing critical issues associated with an increasingly urbanized and resource-constrained world. Research advances in this focus area capitalize on the major role that Arizona can play in the future of energy technology, education, and commercial development related to ensuring the protection and availability of natural resources for the future. These endeavors are fostering economic growth through research, which enhances the attractiveness of Arizona to outside investors.

Programs supported in the Water, Environmental and Energy Solutions focus area and associated goals include:

- The **LightWorks** initiative brings together ASU's energy activities and broad sustainability strengths to tackle complex energy problems. LightWorks is a unique strategic framework within the Julie Anne Wrigley Global Institute of Sustainability centered on an innovative photon-driven economy approach for the future. Capabilities range from basic research on biofuels and new materials discovery for photovoltaics to the applied developments of complex algorithms coupling weather forecasts with electrical grid distributions.
- The **Decision Theater Network (DTN)** engages researchers and leaders to visualize and identify solutions to complex problems. With locations in Tempe and in Washington, D.C., DTN facilities provide the latest expertise in collaborative, computing and display technologies for data visualization, modeling and simulation. The network addresses cross-disciplinary issues by drawing on ASU's diverse academic and research capabilities.



"TRIF funds enabled the LightWorks Solar Power Labs to further advance the design and manufacture of a dilute nitride tandem solar cell. This capitalizes on the unique capabilities of Solar Power Labs and offers unique high efficiency at a lower cost in the field of photovoltaic technology."

– *Christiana Honsberg, director of Solar Power Labs*



"TRIF investments are central to the mission of LightWorks to provide energy options to society. LightWorks aims to have an impact in Arizona through education, discovery research and solutions. By supporting these three channels of work we support policy making, technology solutions, human capacity development, job creation and economic development."

– *Gary Dirks, director of LightWorks*



Summary of Accomplishments

TRIF investments in the **Water, Environmental and Energy Solutions** focus area have resulted in numerous advancements in research, education and discovery that are positively impacting the economy and society.

Results – Impact

- **LightWorks realized a number of strategic successes this year including:**
 - Securing \$22 million in highly competitive funding for continued research and education at the Engineering Research Center for Quantum Energy Sustainable Solar Technology as well as a prestigious Department of Defense ARPA-E funding award, which leveraged research initially funded by TRIF.
 - Finalizing an agreement with Aora Solar to build a concentrated solar thermal experimental and demonstration power plant on the Tempe campus and fund \$1.5 million in research.
 - Attracting over 100 attendees to Solar Summit IV. Participants gained an improved understanding of Arizona's current energy market conditions and learned actionable ideas for accelerating the penetration of clean technologies in the current market.
- **Accomplishments of the Decision Theater Network in the past year include:**
 - Remaining on the forefront of digital storytelling through a partnership with MapStory Foundation. This project and DTN have been featured in national media outlets such as The Washington Post, National Geographic and The Arizona Republic.
 - Constructing functional models to assess oil and gas investment and creating visualizations for SIGA Technologies, Inc.
 - Collaborating with the McCain Institute to deliver a policy design and internship program.



“TRIF investments make it possible for Decision Theater Network staff to undertake innovative, experimental and cutting-edge research efforts, which emphasize visualization and modeling of complex data.”

– Benjamin Freakley, Decision Theater Network
Executive Director

This page intentionally left blank.



**NORTHERN ARIZONA
UNIVERSITY**

This page intentionally left blank.



In spring of 2011, the Arizona Board of Regents approved three initiatives under Northern Arizona University's FY12-FY16 TRIF Business Plan: **Water, Energy and Environmental Solutions (WEES)**, **Improving Health (IHealth)** and **Access and Workforce Development (AWD)**. Northern Arizona's University's research strengths in environmental and climate sciences, wind energy, biosciences and healthcare serve as the foundation upon which the **WEES** and **IHealth** initiatives build increasingly visible and ambitious programs that contribute to Arizona's economic vitality. Northern Arizona University's **AWD** initiative also supports the state's economic growth, through the development and delivery of courses and degree programs that support workforce development in areas such as health, teacher education, and business and nonprofit management.

In FY2014, NAU invested TRIF dollars in some new ways—bringing new research centers online, recruiting new faculty and post-doctoral scholars to the university, and establishing new research-intensive programs that build upon existing strengths and that will lead to innovation and economic impact.

For example, in FY2014 NAU invested TRIF funds to establish a nationally-competitive **Informatics and Computing Program (ICP)** that will enable NAU researchers to utilize fundamentally new “big data” approaches to scientific investigation across almost all academic disciplines. The establishment of the ICP ensures that NAU will remain competitive in increasingly data-driven research in areas relevant both to WEES and IHealth. The ICP is expected to increase extramural research funds considerably.

Paul Flikkema,
Professor of
Electrical
Engineering, was
appointed Director
of the Informatics &
Computing
Program (ICP) in



Dr. Flikkema's work on the SEGA project (Southwestern Experimental Garden Array) makes him the ideal choice to lead this important interdisciplinary initiative. Flikkema aims to ensure that all NAU researchers are familiar with computational concepts, algorithms, and techniques.



In FY14, NAU acquired Monsoon, a high-performance computing cluster with 450 Intel Xeon cores, 10TB of memory, and a peak compute performance of 8 teraflops.

In addition, the financial return on NAU's previous TRIF investments was substantial in FY2014. The financial impact of the university's TRIF investments to date exceeded our goal in FY2014 by almost \$2.5 million and exceeded our FY2013 goal by more than \$6 million. Most notably, late in the fiscal year the university received a prestigious \$1 million award from the W. M. Keck Foundation to establish a Center for Bioengineering Innovation in the College of Engineering, Forestry and Natural Sciences.



WATER, ENERGY & ENVIRONMENTAL SOLUTIONS (WEES)

Northern Arizona University's TRIF investments under the WEES initiative address a number of projects designed to identify and catalyze economic opportunities that sustain Arizonans' environmental and social values. In FY2014, NAU leveraged historical strengths in environmental science and policy, climate science, and wind energy to introduce new, ambitious projects that will contribute to building Arizona's sustainable future. One of these is the **Ecosystem Science and Society Center (EcoSS)**, an inter-disciplinary research and research training program focusing on understanding ecosystems—how and why they change—and to bring tools and perspectives from ecosystem science to the ecology of an integrated Earth. The center is already attracting substantial extramural funding, outstanding and entrepreneurial faculty, post-docs and graduate students, and is expected to generate innovative intellectual property that can be commercialized through licensing and the formation of university start-ups. EcoSS joins the following NAU research centers currently support by TRIF:

Goals

- **Ecological Restoration Institute.** Provide leadership to develop solutions to the costly environmental problem of degraded forest health, water quality and availability and alternative energy fuel in the form of biomass and biodiesel. Contribute to workforce development by providing quality undergraduate and graduate funding, fieldwork, and education in forest restoration.
- **Landscape Conservation Initiative.** Engage students, decision makers, and the public in meaningful dialog, grounded in robust science, to help forge solutions to landscape conservation and sustainable community development.
- **Institute for Sustainable Energy Solutions.** Build research capacity in renewable energy innovation through cutting-edge research and development of strong external partnerships.
- **Merriam-Powell Center for Environmental Research.** Expand and market the availability of field stations, experimental arrays, and facilities for geospatial analysis and biodiversity studies. Such expanded capability and visibility will be aimed both at increased leveraging of grant funding and at a transition toward self-sustaining status for the field stations and facilities.



The mission of the Center for Ecosystem Science and Society (EcoSS) is to conduct research on ecosystems and investigate how they respond to and shape environmental change; to train future scientists, and to communicate discoveries to the public.

(Photo Courtesy of Steve Rich)



Summary of Accomplishments

In FY2014, NAU invested TRIF funds in a number of exciting projects and activities under the Water, Energy and Environmental Solutions initiative. These investments are intended to stimulate economic development through research innovation, partnerships in sustainable solutions research, research training, and commercialization of intellectual property.

Results - Impact

- In FY2014, NAU invested TRIF funds to acquire a custom, state-of-the-art (and first of its kind in Arizona) unmanned aerial vehicle (UAV) equipped with a hyperspectral camera and lidar scanning capabilities that will enhance remote sensing across a number of research disciplines. This UAV brings research and land management capacity to NAU that is expected to attract external funding and partnerships with state and federal agencies as well as private industry.
- NAU recruited two world-class scientists from the University of Florida. Ecosystem ecologists Ted Schuur and Michelle Mack will join the College of Engineering, Forestry and Natural Sciences through NAU's new Center for Ecosystem Science & Society (EcoSS).
- Postdoctoral Scholar Eric Morgan disclosed 4 inventions in FY2014, including the patent pending "Graphene-based Synthetic Leaves for Passive Water Pumping, Cooling, and Humidification". Morgan was one of thirteen postdoctoral scholars hired in FY13 as part of the Support for Post-Doctoral Associates (SPA) Program, a TRIF-funded program intended to infuse new research expertise and inter-institutional collaborations into the NAU research enterprise.
- The NAU Institute for Tribal Environmental Professionals received \$2.8 million in FY14 from the Environmental Protection Agency (EPA) to support the training program, "National Tribal Forum on Air Quality".
- Merriam-Powell Center for Environmental Research (MPCER) sponsored the 12th Biennial Conference of Science and Management on the Colorado Plateau in September, 2013. The conference attracted more than 410 scientists, land managers, and students from as far away as Alaska and Washington, DC. and was co-sponsored by a number of organizations included the USGS, National Park Service, the Grand Canyon Trust and the U.S. Bureau of Land Management.



Remote-sensing ecologist Teki Sankey stands with a miniature, functioning model of the newly-acquired UAV, equipped with a hyperspectral camera and lidar scanner.



IMPROVING HEALTH: INVESTING IN BIOTECHNOLOGY AND BIOENGINEERING

The mission of the I-Health initiative is to position the university to translate discoveries and new knowledge into economic activity.

Goals

- **Build Capacity in Technology Transfer.** NAU seeks to strengthen internal capacity in technology transfer by implementing a vigorous technology transfer strategy that maximizes the potential for NAU research outcomes to lead to commercial products and services, yielding economic benefit for the state of Arizona.
- **Catalyze development of intellectual property (IP).** NAU provides project-based financial support to faculty whose research has the potential to generate outcomes suitable for licensing to established companies and/or the formation of spin-offs. NAU is building and strengthening relationships with state-wide partners to enhance technical assistance necessary to grow successful spin-offs.
- **Build institutional capacity to expand bioscience research.** NAU has implemented competitive internal grant programs that make targeted, strategic investments in bioscience-related research. These investments strengthen the institution's commitment to and participation in the statewide Arizona Bioscience Roadmap.
- **Invest in the Center for Microbial Genetics and Genomics.** NAU's investments in MGGen enhance synergies between Northern Arizona University and the Translational Genomics Research (TGen) Institute through the support of individuals jointly appointed.
- **Strengthen the northern anchor of Arizona's biomedical corridor.** NAU's new Health Research Initiatives (HRI) program expands existing research efforts targeted at biomedical, translational, and community health research. It establishes strong partnerships with medical centers and communities in the region, such as Flagstaff Medical Center and Northern Arizona Healthcare.



3D printed model of the Discovery Channel Telescope currently on display at the Lowell Observatory. The model was designed by Tanya Gallagher and John Tester of NAU's Realization of Advanced Products and Innovative Designs Laboratory (RAPID Lab), established under the TRIF program in FY2013. Photo Courtesy of Lowell Observatory.



Summary of Accomplishments

In FY14, NAU continued to invest TRIF dollars in research in the biosciences, health care research and biotechnology in order to strengthen and expand NAU's impact on Arizona's economy.

Results - Impact

- NAU signed an MOU with Northern Arizona Healthcare to establish **THRIVE**, a partnership focused on translational and population health research to improve health outcomes in Northern Arizona.
- Regents' Professor Kiisa Nishikawa received \$1 million from the W. M. Keck Foundation to establish a new Center for Bioengineering Innovation. "The prestige of an award from the W. M. Keck Foundation is thought to accelerate innovation," said Nishikawa. "TRIF was instrumental in getting this award; the initial collaboration and the collection of the preliminary data on atomic force microscopy that we presented during the site visit were all funded by TRIF."
- Partnered with Flagstaff Medical Center to develop a successful \$200,000 proposal to the Flinn Foundation for a joint research project to improve evidence-based programs for transitional care in home and community settings.
- NAU Innovations licensed patent-pending technology, Moist Membranes for the Cultivation and Collection of Algae (MOMECCA), to a start-up company, SCORE Algae, through ASU's Furnace accelerator. SCORE plans to use MOMECCA to produce and sell crude oil made from algae using solar energy.



THRIVE (Translational Health Research Initiative) is a partnership between NAU and Northern Arizona Healthcare designed to catalyze and facilitate increased collaborative research in biomedical, behavioral, and community health for the diverse populations of Northern Arizona.



Jeffrey Trent, TGen president and research director (left), presents a plaque to NAU President John Haeger commemorating the first patent jointly issued to TGen and the Arizona Board of Regents (on behalf of NAU). NAU and TGen entered into a **five-year agreement** to promote research and innovation. "TGen is a shining example of the innovative companies we seek to attract and expand in Arizona," said Gov. Jan Brewer. "By enhancing the successful partnership between TGen and NAU, we can ensure that both our bioscience industry and our economy will continue to thrive for years to come." *Photo Courtesy of NAU News*



ACCESS/WORKFORCE DEVELOPMENT

One of Northern Arizona University's (NAU) strengths is access and workforce development. For over 30 years, NAU has served rural and urban communities throughout Arizona, providing opportunities for place- or time-bound citizens to continue their educational progress. Three-quarters of NAU's Extended Campuses students work at least 32 hours per week.

This initiative focuses on shortages of teachers, health-care professionals, trained managers and information technology professionals. The goal is to make quality programs available in locations and through delivery methods that suit student need. Thirty-six rural and urban sites offer face-to-face contact, a wide variety of on-line and hybrid programs, and flexible scheduling, all of which support students to learn while balancing work and other commitments. Courses can be completed in as little as seven weeks and numerous programs allow students to transfer as many as 90 credit hours from an Arizona community college, leaving only 30 NAU units needed to complete a bachelor's degree. These transfer friendly programs are among the most affordable four year degree options in the state of Arizona. Students can reach out to their local NAU contact or use the Extended Campuses Service Center, which is available by toll-free phone, email, and online chat for a wide range of student support services.

Partnerships with Arizona community colleges continue to thrive. The 2NAU joint admission program continues to attract students as it is structured to provide access to a four-year degree through seamless transition from the community college to NAU. Students are jointly admitted to their community college and NAU so their coursework at each institution is tailored to ensure their goals are met in the most affordable and efficient way. The program's more than 4,500 participants as of June 2014 reflect the statewide demand for this innovative pathway (including participants from the Maricopa Community College District, Cochise Community College, Pima Community College, Central Arizona Community College, Eastern Arizona Community College, Mohave Community College, Yavapai College, Arizona Western College, and Coconino Community College).

Extended Campuses conducted a thorough review of the enrollment process during the 2012/13 academic year. With a focus on removing obstacles to enrollment and identifying opportunities to improve the service and information provided to students, this evaluation resulted in significant staff reorganization and improved business processes. As most of the students pursuing AWD programs are adults who work and have other commitments, streamlining the processes surrounding enrolling in classes is essential to their success. These efforts continued during the past year with the implementation of an online new student orientation that provides students with much of the information they need to begin at NAU in a standardized format they can access at their convenience. Initial data suggests the online orientation is beneficial with 91% of completers indicating the content was relevant and useful. Continued efforts to streamline and simplify business processes will take place during the upcoming year to support NAU's on-going commitment to offer programs that best serve the needs of Arizona.



E-LEARNING

Established in 2001, the e-Learning initiative has been improving student learning and supporting successful degree completion through engaging, effective and efficient use of technology. Over the past year the eLearning Center's focus has been to support university initiatives to improve the quality of instruction across all learning modalities. First, as a member of the state-wide Quality Matters consortium, NAU has collaborated with ASU, UA and various community colleges to educate and train faculty and staff state-wide in the use of the Quality Matters Rubric designed to set national standards for quality design of Online and Blended courses. Over 60 NAU faculty and staff completed the "Using the QM Rubric" course taught by the three Quality Matters certified NAU trainers. Second, the initial set of blended courses redesigned as part of the President's Technology Initiative was fully implemented in FY14. The majority of these courses showed cost savings as well as similar or improved learning outcomes.

The e-Learning Center continues to provide online and in-person training for faculty and staff on sound course design and practical use of Blackboard Learn and other instructional technologies. The Center's six instructional technologists and two instructional designers consult with faculty on instructional methods, learning activities, and technical issues. Three multimedia designers collaborate with faculty to create engaging videos, audio recordings, animations, and other instructional media that effectively convey course concepts.

In addition to monitoring current research on teaching and learning, the Center investigates the changing technological landscape to assess which new offerings and techniques best meet the needs of students and instructors. Faculty who work with the Center value the personalized support they receive and they often explore new ways of teaching, confident that they are backed by a team of knowledgeable professionals.

The e-Learning Center's Faculty Help Desk has long provided telephone support during regular university business hours. Beginning in fall 2014, telephone support will be available until 10 p.m. on weekdays and an additional 14 hours on weekends. Email support continues to be available after hours. The Help Desk's staff and student workers collaborate with technology vendors and with other support organizations on campus to quickly respond to more than 13,000 help requests annually. Satisfaction surveys indicate that faculty find the Center's efforts to be highly effective.

Two initiatives launched in a prior year, continue to gain traction with faculty. The first is the use of a uniform template when creating online, blended or web enhanced face-to-face courses. The use of this template provides for greater consistency of course look and feel within and across the disciplines and departments. The goal of this initiative is to help students and faculty to focus on learning rather than spending unproductive time navigating and trying to understand a peculiar course structure. A second project is the use of two new training courses for faculty, one is a basic technology skills course and the second is a course on teaching with and through technology. The teaching course is technology agnostic with a focus on pedagogy and teaching techniques grounded in learning research that will engage students in online and blended courses.

This page intentionally left blank.



 THE UNIVERSITY
OF ARIZONA

This page intentionally left blank.



At the University of Arizona, TRIF promotes the economic development of the state by catalyzing innovative research in target areas of high impact; facilitating the translation of research results into new products and services that benefit the health, security, and prosperity of Arizona; and educating students—from elementary to graduate school—to be science and innovation leaders who will create Arizona’s bright high-technology future. TRIF activities fall under four initiatives:

- **Improving Health** supports UA researchers who are tackling complex and pressing health problems of critical importance to Arizona and the nation, as well as major challenges in the agricultural sciences. New hires in the BIO5 Institute have made significant progress on novel therapies and treatments for a wide range of diseases. Researchers also submitted an Investigational New Drug application for the use of oral microbial products in the prevention of asthma in preschool children and expanded computational tools for use in other life science research. BIO5 also helped connect students with employers in the region, building Arizona’s workforce of the future.

- **Space Exploration and Optical Solutions** seeks to expand educational opportunities for students in optics, incubate novel research directions, and impact regional economic development by leveraging the University’s world-renowned optics education and research resources. New developments in imaging are improving baggage screening for airport security and advancing research on skin cancers. Research in photonics will support future growth of the Internet and give rise to new sensors and electrodes for use in solar energy applications.



*Kimberly Espy, Senior Vice
President for Research*

“TRIF funding enables the UA to jump-start research in areas critical to Arizona, innovate technologies, train our future scientists and engineers, and transform visionary ideas into commercial success. This improves the lives and health of Arizonans and the prosperity of the state.”

- **Water, Environmental and Energy Solutions** seeks sustainable solutions to Arizona’s water, environmental, and energy resources challenges, with far-reaching societal benefits. Among FY14 accomplishments, WEES helped advance new water quality analysis and treatment technologies, trained managers in post-wildfire ecosystem recovery, developed creative designs for the I-11 Supercorridor, and collaborated with industry to support Arizona’s flourishing solar power industry.
- **Tech Launch Arizona**, the UA’s technology commercialization unit, aims to accelerate the process of moving UA discoveries from the laboratory to the marketplace, providing a more direct avenue for UA inventions to create economic and social impacts in Arizona. In FY14, TLA helped establish 11 new start-up companies based on UA intellectual property. These companies bring jobs to southern Arizona, attract partners and millions of dollars in development capital, and create economic growth for the state and its citizens.



IMPROVING HEALTH

TRIF investments in **Improving Health** have allowed the BIO5 Institute to bring together world-class biologists, engineers, and physician-scientists to develop bold solutions for complex biological challenges facing Arizona such as disease, hunger, and water safety. With its unique combination of assets—bioscience research institutes, a strong medical school, a health sciences campus and teaching hospital, outstanding clinical expertise, and technology commercialization—the UA is positioned to translate research into health solutions that benefit the people and economy of Arizona.

Goals

- *Foster collaborative projects that address major challenges* in the biosciences, biomedicine, and biotechnology and *forge significant progress on novel treatments* for asthma, cancer, valley fever, diabetes, sudden cardiac death, degenerative eye disorders, and Alzheimer's and other brain diseases.
- *Strengthen and expand translational research* by recruiting the best and brightest faculty to Arizona and supporting projects that will advance the development of new medicines, devices, diagnostics, and therapeutic strategies.
- *Engage and train our future generations of scientists* by maintaining successful outreach and internship programs to promote experiential learning and STEM literacy in the state.
- *Establish shared resources* in computational biology, imaging, high throughput screening, genomics, proteomics, and cell sorting to expedite large-scale, team science grants that will boost research funding, serve as a resource for local industry, and create new services and companies in Arizona.
- *Promote an entrepreneurial culture* in which scientists work across disciplines to accelerate commercial translation of research breakthroughs.



The BIO5 Institute in the Thomas W. Keating Bioresearch Building

TRIF funding that helped launch BIO5 continues to catalyze major health initiatives that provide a return on investment to the people of Arizona.

Student/industry networking events, career fairs, and internship programs with biotech leaders such as Ventana Medical Systems and Sanofi connect students with employers in the region, building Arizona's workforce of the future.



KEYS Research Internships engage the best and brightest high school students from across Arizona in hands-on research to attract them to the UA and to bioscience degrees and jobs in our state.



Summary of Accomplishments

Researchers supported by TRIF continue to push the boundaries of knowledge, facilitate cutting-edge science breakthroughs, and garner international recognition for the impact of their work. NIH-funded translational work by Jil Tardiff, professor in the College of Medicine, is now coupled with her UA Genetic Cardiomyopathy Clinic, which drives referrals from across the U.S. to Tucson and is leading the creation of a worldwide consortium to study the disease. Todd Camenisch, associate professor of pharmacology and toxicology, and Joyce Schroeder, professor of molecular and cellular biology, partnered to launch Arizona Cancer Therapeutics LLC, a development stage company advancing novel cancer drugs to clinical trials, thus creating jobs and translational work. Carol Barnes, a leader within the Arizona Alzheimer's Consortium, was awarded the top honor in the field of neuroscience for her groundbreaking work on changes that take place in the aging brain. The UA hired Yves Lussier, world-renowned bioinformatician now at BIO5, to develop programs in biomedical informatics and computational genomics to advance precision health.

Results – Impact

- \$50M in new grant awards, including \$4.7M in new, external funding to top physician/scientists recruited and hired by BIO5.
- A major step forward in novel asthma prevention for preschool children with the successful submission to the U.S. Food and Drug Administration of an Investigational New Drug (IND).
- iPlant cyberinfrastructure and computational tools developed at BIO5 now used by researchers worldwide for innovative work across life science disciplines.
- More than 350 publications, including a journal article in *Nature* by Dr. Bentley Fane on a revolutionary advance in the treatment of viruses.
- Science City at the Tucson Festival of Books, the single largest STEM-themed event in Arizona co-organized by BIO5 and the College of Science.



In partnership with the Arizona Health Sciences Center, BIO5 is focused on promoting prevention, early detection, and better disease management for the people of Arizona with the development of new diagnostic tools, biomarkers, data-driven discovery, and advances in genomics. One new development is an innovative microscope and lens that can image human brains to better understand normal and abnormal brain function.



A BIO5-AHSC research team was awarded a Flinn Foundation grant to further precision health in the state as part of Arizona's bioscience roadmap. The study will focus on the role viruses play in lung infections and could hold promise for faster diagnosis and effective patient treatment.

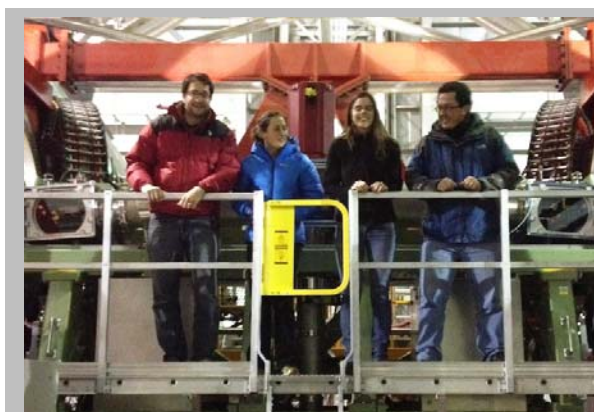


SPACE EXPLORATION AND OPTICAL SOLUTIONS

The TRIF **Space Exploration and Optical Solutions** initiative seeks to expand educational opportunities for Arizona students in optics, incubate novel research directions, and impact regional economic development by leveraging the University's world-renowned optics education and research resources.

Goals

- *Leverage TRIF funds* to obtain at least a 10X return on investment through increased external research funding to support more students.
- *Identify and support key optics faculty hires* in strategic areas of Arizona need and/or opportunity across the UA campus.
- *Create new shared imaging and photonics infrastructure and facilities* that broadly benefit the research and education mission of the UA.
- *Support Arizona workforce development* directly through increased student fellowships and enhance the UA's outreach to companies and underrepresented populations in Arizona to help increase the number of trained minority students.
- *Encourage technology transfer*, helping the creation of new Arizona start-up companies and expanding innovation activities.



Andrew Skemer, Department of Astronomy (left), and colleagues in the scaffolding of the Large Binocular Telescope.

"Thanks to support from TRIF, our team will construct an imaging spectrometer for the LBT that will give us unprecedented insights into the nature of exoplanets in our galaxy that we can now directly observe with the LBT."

Summary of Accomplishments

Investments in the Space Exploration and Optical Solutions program have spawned exciting new faculty research directions, new research infrastructure, and enhanced outreach programs. For Amit Ashok, assistant professor of optical sciences, TRIF financial support was instrumental in training graduate students and investing in critical equipment that validated innovative X-ray computational imaging approaches with applications in both security and medicine. Based on this investment, Dr. Ashok and his collaborators secured \$3.7M in research grants from the Department of Homeland Security to target new designs for next generation X-ray baggage screening machines for airport security.

The TRIF Imaging team has supported a diverse set of infrastructure and seed research grants, as well as fellowship support for graduate students. Andrew Skemer, senior research associate in the Department of Astronomy, is developing new instruments for the Large Binocular Telescope, which will provide UA scientists with unrivaled capabilities for studying exoplanets.



In photonics, TRIF funding has been invaluable in securing the \$23.1M NSF funding received to date for the Center for Integrated Access Networks (CIAN) Engineering Research Center led by Nasser Peyghambarian. TRIF funding for new infrastructure, faculty, and students has propelled the College of Optical Sciences into a prominent leadership role in research enabling the future growth of the Internet.

The first class of students enrolled in the new Master of Science in Photonic Communications Engineering, with potential positive impacts for regional Arizona industry and entrepreneurship. Optical Sciences professors Charles Falco and Masud Mansuripur received TRIF funding to support two graduate students working on nanotechnology for solar energy, and their seed project results were leveraged for a new grant from the Qatar National Research Fund.

The Space Exploration and Optical Solutions initiative also continues to excel at workforce development, providing salary support to 56 graduate and post-docs in the Colleges of Science, Engineering, and Optical Sciences as well as additional student support for participation in national industry/academia workshops; outreach through the Research Experience for Undergraduates and Research Experience for Teachers, targeting schools primarily serving Native American students; student leadership lunches; Women in Optics; and the CIAN Young Scholars Program, which promotes STEM education by providing high school students with opportunities to work in research laboratories.

Results – Impact

- \$45M in new TRIF-seeded research funding to fuel regional economic development.
- Funded 56 graduate student research assistantships and post-docs to ramp up the local talent pool.
- 19 invention disclosures, 4 patents issued, 8 licenses and options, and 1 Arizona start-up company.
- 71 scientific conference presentations and 181 journal publications.



*Clara Curiel, Associate
Professor of Dermatology,
UA Cancer Center*

“TRIF funding has provided the Cancer Center with a state-of-the-art VivaScope 1500 Multilaser in-vivo confocal microscope to enable advances in basic and clinical research on skin cancer, a serious concern for Arizona residents.”



*Chih Yu Huang,
PhD student,
Optical Sciences*

“TRIF funding has been invaluable in providing a diamond-turning free-form optical surface generator for realizing unprecedented new optical designs. This provides a tremendous advantage to our research infrastructure and promotes collaborative opportunities with regional companies.”



The **Water, Environmental and Energy Solutions** initiative is developing innovative, practical solutions necessary for water, environmental, and energy sustainability in Arizona and other semiarid regions facing increasing demands on natural resources and the uncertainties of climate variability. WEES projects are helping secure adequate supplies of clean water for Arizona's economic vitality, provide a knowledge foundation to optimize the sustainable use of Arizona's lands, build resiliency to drought and other climate variability, and lead the creation of a vibrant renewable energy industry in the state.

Goals

- *Build on the UA's world-renowned expertise* in water and climate variability and its emerging excellence in the renewable energy sector to enhance multidisciplinary collaboration for science, technology, and policy studies.
- *Focus on use-inspired research* performed by multidisciplinary teams that will result in innovative, practical solutions.
- *Leverage investment in strategic areas* to increase public and private sector funding and increase the rate of technology transfer and commercial development.
- *Train a new generation* of scientists, engineers, and other professionals.

Summary of Accomplishments

WEES funding directly benefited Arizona's water resources and economy. UA researchers demonstrated the effectiveness of using sonolysis to treat trace organic contaminants in wastewater for safe water reuse; they now are moving toward commercialization of this technology, which has the potential to solve wastewater treatment problems in Arizona and around the world.



"Fires are 10 times as large now as they were a decade ago, and that trend is likely to continue."

Donald A. Falk, lead scientist for FireScape and associate professor, School of Natural Resources and the Environment

A WEES-sponsored workshop of the Southwest Fire Science Consortium drew 183 stakeholders from Arizona and eight other western states to help fire and ecosystem managers and scientists address ways to support ecosystem resilience under changing climate conditions.



Anthony Lorenzo, PhD student, Optical Sciences and Physics

UA researchers are collaborating with Tucson Electric Power Co. to develop solar power forecasts and integrate them into TEP operations. Ground-based sensors collect data on cloud formation, which are then combined with satellite data to build a complex forecasting model for energy from the sun.



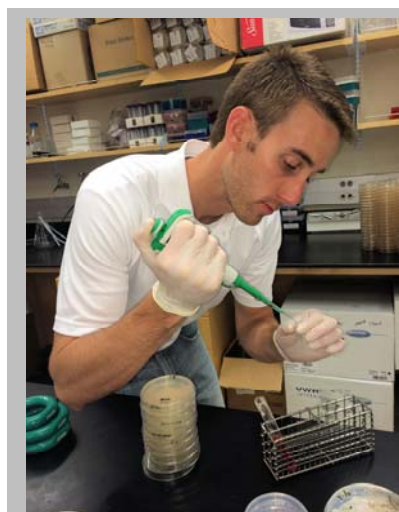
Other researchers developed environmental metabolomics that permit rapid screening of environmental contaminants such as arsenic, a common Arizona groundwater contaminant, to determine their risk to human health. WEES-funded activities also led to a UA grant from the U.S. Department of the Interior to investigate future Colorado River Basin streamflow under a variety of scenarios; the project has matching funding from the U.S. Bureau of Reclamation, Central Arizona Project, and Salt River Project.

In addition, WEES funds were used to establish the Center for Climate Adaptation Science and Solutions, which will unite UA expertise with Arizona and regional stakeholders to support climate preparedness, resilience, and management decisions. In a separate project, 43 UA students and faculty worked with peers at ASU and UNLV to develop design-based proposals for the future I-11 Supercorridor to increase sustainable outcomes.

WEES funding also resulted in advancements for renewable energy in Arizona. Sandy D'Allerba, associate professor in the School of Geography and Development, completed the first economic impact analysis of a new photovoltaic facility in Arizona. In another project, researchers in the Department of Materials Science and Engineering developed a new approach to model and predict the degradation of photovoltaic modules. This energy generation reliability evaluation research strengthens the UA's position as a center for full-spectrum PV performance evaluation and application in support of Arizona's renewable energy economy.

Results – Impact

- \$50M in new grants and gifts to the UA from WEES investments in faculty and research.
- 255 graduate students, 99 undergraduate students, and 41 post-docs funded through assistantships, wages, scholarships, grants, and research experiences.
- 26 new invention disclosures, 17 patent applications filed, 1 patent issued, 1 start-up company, and 4 licenses and options.
- 116 presentations, workshops, conferences, and other events, including “Closing the Gap Between Water Supply and Demand,” a conference hosted by the Water Resources Research Center and the Arizona Department of Water Resources that drew 350 people from 43 Arizona communities and 6 tribes to examine how Arizona might fill the growing water supply gap in the Colorado River Basin.



Marc Verhougstraete, post-doc research associate, Environmental and Exposure Sciences Risk Assessment Center

ESRAC, which brought in more than \$2.5M in grants and industry contracts in FY14, is partnering with government and industry leaders to explore the use of supplemental air disinfection systems to reduce pathogens commonly associated with healthcare infections.



TECH LAUNCH ARIZONA

Tech Launch Arizona seeks to be a key leader in the UA's mission to contribute to the economic development of southern Arizona and the nation by fostering innovation, expediting technology commercialization, and generating new companies suitable for professional investment financing. Through comprehensive services, TLA addresses the entire “idea to impact” continuum: bringing ideas from their beginnings in scientific research, through defined commercial pathways, to the marketplace, where they can create powerful economic and social impacts.

For example, Glycosurf, a start-up company founded by UA researcher Clifford Coss and professors Jeanne E. Pemberton (Department of Chemistry and Biochemistry) and Raina M. Maier (Department of Soil, Water and Environmental Science), is commercializing UA-developed surfactants for new high-purity, high-performance “cosmeceuticals”—the combination of cosmetics and pharmaceuticals—and personal care products that should appear on store shelves within the next year.

Goals

- *Engage faculty researchers* to encourage participation in the commercialization process and promote a culture of service excellence across TLA.
- *Expedite movement of UA research-derived intellectual property into the commercial sphere* to foster the further development of these assets along the appropriate commercial trajectories.
- *Promote engagement with private businesses* by ensuring UA research, knowledge, intellectual property, and Tech Parks assets are fully leveraged for mutually beneficial outcomes.
- *Grow the UA's return on its efforts* through an enhanced reputation, a larger economic development impact in Arizona, increased industry-sponsored research, and greater licensing revenues.
- *Expand the Proof of Concept Program* to exceed \$700K in FY15 to spur even greater development of intellectual property, licensing revenues, and start-ups.



Clifford Coss, UA researcher and co-founder of start-up Glycosurf



Summary of Accomplishments

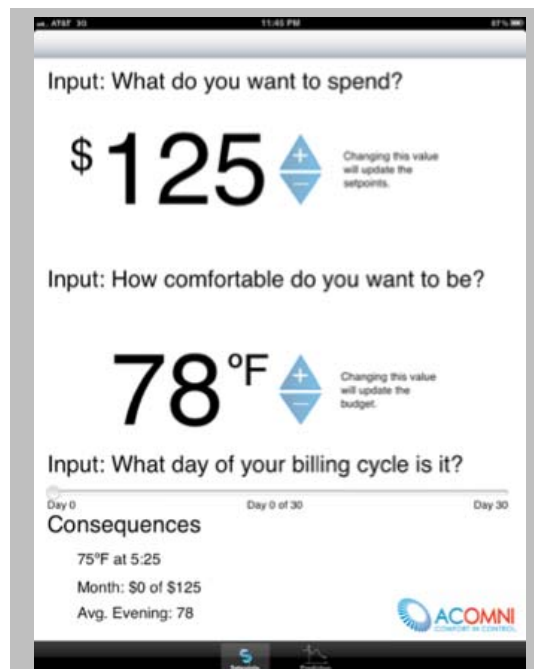
TLA further strengthened business and research partnerships to expand the UA's capacity for technology commercialization. TLA continues to fulfill a central role in the overall UA mission to create a positive impact on the Tucson and southern Arizona economies.

One key measure of TLA's regional economic influence is the creation of start-up companies founded upon university-developed technologies. Over the past five fiscal years, the UA has created 26 new Arizona-based companies in one of the toughest economic climates in decades. During FY14 alone, TLA was instrumental in helping create 11 start-up companies, compared to three in FY13.

To help successfully launch the highest-potential new technologies, TLA directly funds a Proof of Concept (POC) Program. More than \$1.3M in TRIF funding has been committed to the program since its initiation in FY13, with significant emphasis on awards to faculty and researchers in biosciences, optics, and renewable energy—target industries as defined by the Arizona Commerce Authority. In FY14, 17 UA inventions were granted POC Program awards, with 12 in the above-mentioned targeted industries. The awards provide funding to faculty and researchers to address technological and commercial hurdles and move promising inventions towards commercialization.

Results – Impact

- 188 invention disclosures (a 31 percent increase from FY13).
- 72 licenses and options (a 50 percent increase from FY13), including 39 exclusive licenses and options.
- 167 U.S. patent applications filed and 24 U.S. patents issued (a 15 percent increase and 11 percent decrease, respectively, from FY13).
- 11 start-up companies, 9 of which are in Tucson (compared to 3 total in FY13).
- \$1.1M patent royalty income (a 20 percent increase from FY13).



Started by Jonathan Sprinkle, assistant professor of electrical and computer engineering, Acomni is commercializing technology to help people save energy and money, allowing them to set their thermostats based on how much they want to spend.

This page intentionally left blank.



EDUCATE • DISCOVER • IMPACT

This page intentionally left blank.



ABOR TRIF FUNDS

The Technology and Research Initiative Fund (TRIF) funds allocated to the board office are used to advance the system and board oversights in accordance with Arizona law, board guidelines and the Arizona public universities' strategic plan. For example, the collection of National Student Clearinghouse data is used to generate several important student pipeline reports presented to the board and the research landing page was designed as a more efficient method to provide the board with the information contained in the Annual Research Report.

In FY 2014, TRIF continued to fund the National Student Clearinghouse (part of a multi-year commitment), ABOR-IT projects, Presentation of the ABOR Annual Research Report; and the ABOR Strategic Plan Rollout. Information concerning each of these TRIF projects is detailed below.

NATIONAL STUDENT CLEARINGHOUSE

ABOR is able to access the clearinghouse data provided back to the Arizona Department of Education. This information is used in analyzing and reporting the postsecondary activity of our high school graduates as relevant to the ABOR Enterprise strategic plan goals and economic development objective of preparing those students to contribute to Arizona's high technology industries.

ABOR RESEARCH INFORMATION TECHNOLOGY

The purpose of the funding is to provide additional support in the area of information technology for the university system. This additional support is in the form of ensuring data and system integrity in the IT systems which support the universities' research mission.

RESEARCH LANDING PAGE & ABOR STRATEGIC PLAN ROLLOUT

A web-based landing page was created to support and enhance the Annual Research Report. In particular, it shows progress toward achieving the system's metrics as well as highlighting the research efforts at all three universities. It is an interactive version of the report with links to additional information at each of the universities research operations.

As part of the ABOR strategic plan rollout, a video was produced which reflects the diversity and culture of each of the universities and how that culture is providing opportunities for students and advancing the research mission.



SCITECH FESTIVAL

The Arizona SciTech Festival is a state-wide celebration of science, technology, engineering and math (STEM or STEAM when you include the arts) held annually in February and March. Through a series of over 400 expos, workshops, conversations, exhibitions and tours held in



diverse neighborhoods throughout the state, the Arizona SciTech Festival excites and informs Arizonans from ages 3 to 103 about how STEM will drive our state for next 100 years. Spearheaded by the Arizona Commerce Authority, Arizona Science Center, the Arizona Technology Council Foundation, Arizona Board of Regents, the University of Arizona and Arizona State University, the Arizona SciTech Festival is a grass roots collaboration of over 450 organizations in industry, academia, arts, civic, community and K-12.

REGENTS' INNOVATION FUND

The Regents' Innovation Fund continues to be instrumental in supporting the research activities of the universities, and in contributing toward the collaborative efforts among the universities and with community partners.

In February 2013, after a competitive process, three new, tri-university collaborative projects were approved for funding: 1) Using Wastewater for Mass Culture of Algae for Food, Feed and Fuel; 2) AEGIS: Arizona Environmental Grid Infrastructure Service; and 3) LiveData: Establishing a Digital Research Infrastructure for Arizona's 21st Century Universities Research Enterprise. These three projects were funded in May 2013 for a combined total of \$1.1million and combine the talent and resources of our three public universities.

In September 2013, a new competitive process opened and approved three tri-university collaborative projects for funding. Both AEGIS and LiveData were approved for a second year of funding, as well as a third project—The Human Gut Microbiota and Its Viruses: Keys to Treating Autism. The annual reports for these three projects, totaling \$1.2 million, are due June 30, 2015.

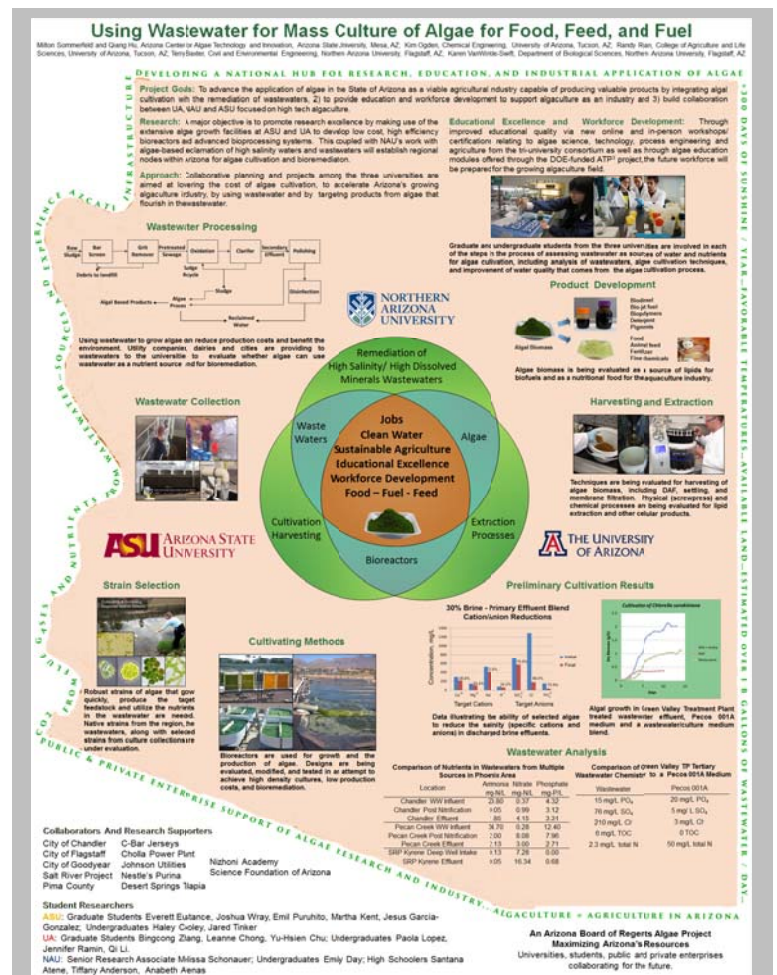


USING WASTEWATER FOR MASS CULTURE OF ALGAE FOR FOOD, FEED AND FUEL

This project links the strengths of the three universities in the algae and water quality fields and several local industries in a substantive way that leads to additional joint research and education proposals. Students at all levels at ASU, UA and NAU were involved in the project. At ASU, three graduate students and one undergraduate; at NAU, one postdoctoral student and one undergraduate; and at UA, three graduate students were involved. Additionally, at NAU, three Native American high school students assisted during the summer. The three universities have engaged with the following Arizona industries in evaluating suitability for algae cultivation: Chandler Airport Water Reclamation Facility, Johnson's Utilities Treatment Plants, Greenfield Water Reclamation Facility, Van Rijn Dairy, SRP's Power Generating stations, Wildcat Hill Wastewater Plant, Rio de Flag Wastewater Reclamation Facility, APS Cholla Power Plant, Goodyear RO Facility; Pima County Green Valley Treatment Plant, Roger Road Water Reclamation Facility, Desert Tilapia, and Casecove Oyster Farm (Seattle, WA).

Several posters and presentations have been produced regarding this project, including this one presented at the Algae Biomass Organization Summit, in Orlando, Florida in September 2013.

The tri-university team will continue to collaborate on the use of diverse wastewaters as an algae cultivation medium and as a means to improve water quality, and to share algae strains and water quality information. The team is exploring new and additional federal/local funding opportunities related to waste/discharge water bioremediation.



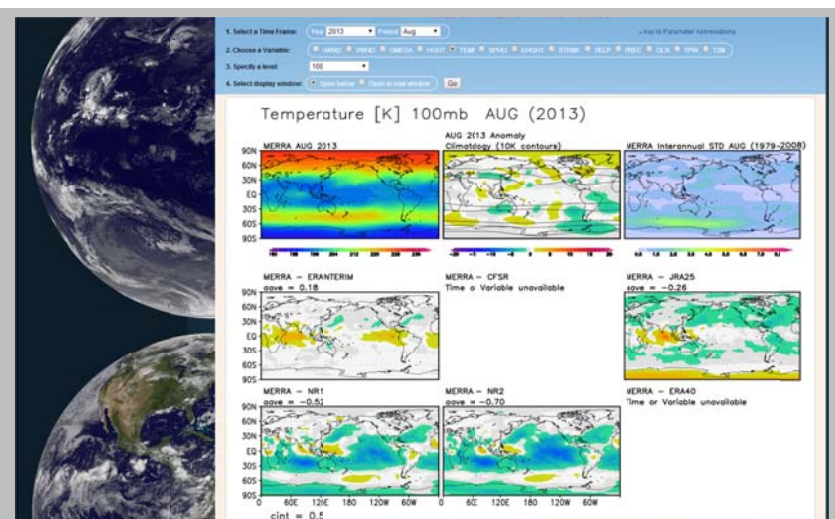
Poster presented: September 2013



AEGIS: ARIZONA ENVIRONMENTAL GRID INFRASTRUCTURE SERVICE

In partnership with NASA, AEGIS enables ASU, NAU UA to access an enormous climate data set. Substantial progress has been made with establishing a direct partnership with NASA's MERRA project, which provides global climate data in the form of a synthesis of 26 key climate variables at six-hour intervals extending from 1979 to the present, nearly the entire satellite era. AEGIS and NASA utilize similar data management systems based on iRODS; this makes access to large scale NASA MERRA data feasible. NASA will officially provide access to this system in the third quarter of 2014. Arizona researchers will be the first group of university researchers to have access to this system.

With the AEGIS tools, universities and agencies will have access to wildfire decision support analytics. RECOVER is a new NASA-funded effort to build wildfire decision support capacity. RECOVER will be adapted to utilize AEGIS's Atmosphere cloud infrastructure and Data Store to enable the types of data analytics required by the wildfire management community. In the fourth quarter of 2014, we will test this implementation for the state of Arizona. Arizona will be the first state outside of the initial beta group to have access to this rapid data assembly and decision support system. This project will be of value to multiple governmental agencies that deal with forest fire decision support and rehabilitation, along with researchers at our universities.



NASA-Global Modeling and Assimilation Office,
<http://gmao.gsfc.nasa.gov/ref/merra/atlas/>

AEGIS-sponsored environmental informatics research is currently analyzing the links between several climate variables (temperature, humidity, wind, etc.) and the documental cases of Valley Fever at hospitals across Arizona in the last decade. AEGIS-developed tools are also being used as part of a joint observational and modeling program to create observationally-based metrics in order to assess model simulations of the Southern Ocean and the global climate and carbon cycle in projecting future climate.

The AEGIS infrastructure has positioned the three universities to pursue joint funding opportunities to create a sustainable regional computational grid.

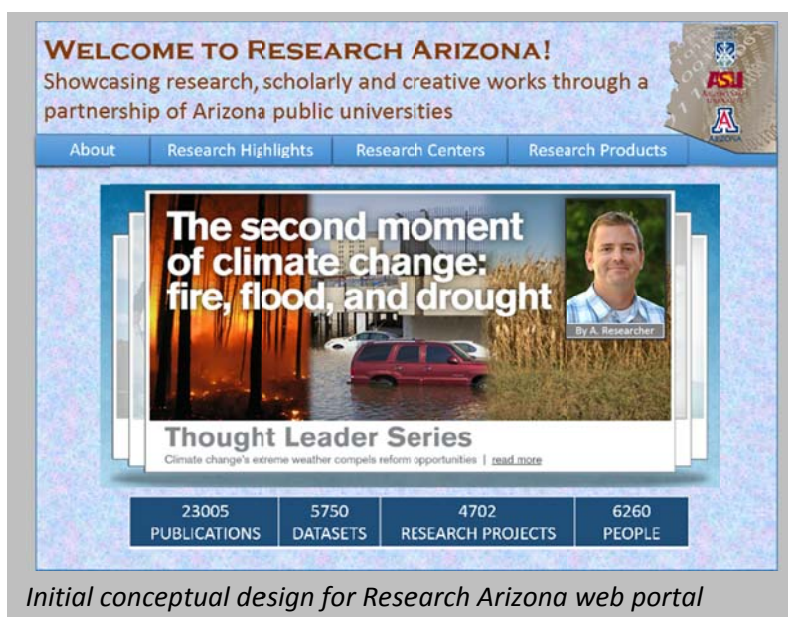


LIVEDATA: ESTABLISHING A DIGITAL RESEARCH INFRASTRUCTURE FOR ARIZONA'S 21ST CENTURY UNIVERSITIES RESEARCH ENTERPRISE

The LiveData taskforce determined that the first deliverable should be a web-based discovery tool that harvests information regarding datasets and scholarly content from each of the participating institutions. The discovery tool will be implemented as part of a tri-university web portal. The portal will provide a single point of access for the research products and scholarly outputs of Arizona's public universities. Links to large scale initiatives and research centers will expand the information available to site visitors. It is expected that the Research Arizona site will provide a significant contribution to marketing our research efforts as well as being a source for information for businesses, the media, and other researchers. This portal is expected to be live in the late fall of 2014.

LiveData is developing a collaboration with the AEGIS (ABOR/RIF funded) project in order to maximize the return on investment from both projects.

When research informatics becomes a core business function at each university, there will be tremendous potential for our public universities to leverage their relationships, technology, and processes to provide a competitive advantage in research activities and grant proposals.



Initial conceptual design for Research Arizona web portal

This page intentionally left blank.

System Summary



TRIF Metrics and Financials

This page intentionally left blank.

**ARIZONA UNIVERSITY SYSTEM
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
FY 2012-2016**

	FY 2012 ACTUAL	FY 2013 ACTUAL	FY 2014 ACTUAL	FY 2014 BUDGET	FY 2015 BUDGET	FY 2016 BUDGET
REVENUE						
Carryforward	\$ 3,142,709	\$ 7,151,749	\$ 7,688,082	\$ 7,646,917	\$ 7,066,441	\$ -
TRIF Revenue	57,256,220	58,464,496	\$ 66,720,070	61,650,400	62,385,000	63,500,000
TOTAL REVENUE	\$ 60,398,929	\$ 65,616,245	\$ 74,408,152	\$ 69,297,317	\$ 69,451,441	\$ 63,500,000
EXPENDITURES						
OPERATING						
Personal Services	\$ 19,115,118	\$ 20,768,253	\$ 23,679,972	\$ 24,671,614	\$ 23,627,775	\$ 22,524,416
ERE	6,422,325	7,104,053	\$ 7,908,115	8,924,693	8,686,470	7,973,517
All Other Operating	14,649,793	19,066,524	\$ 18,661,268	16,936,139	16,948,004	17,521,467
Grants/Projects	659,993	1,923,049	\$ 3,178,080	3,726,527	4,217,092	1,750,000
TOTAL OPERATING	40,847,228	48,861,879	53,427,435	54,258,973	53,479,341	49,769,400
CAPITAL						
Building Renovation	400,126	140,000	1,416,656	1,090,000	1,640,000	1,080,000
Debt Service	6,430,990	6,206,984	8,288,221	8,739,304	9,626,500	7,633,956
ASU Polytechnic/West COPS	3,716,100	3,719,300	3,709,400	3,709,400	3,704,000	3,707,500
AZUN	500,000	500,000	500,000	500,000	500,000	500,000
Equipment Acquisition	962,046	-	-	999,640	501,600	809,144
TOTAL CAPITAL	12,009,262	10,566,284	13,914,277	15,038,344	15,972,100	13,730,600
EXPENDITURES TOTAL	\$ 52,856,490	\$ 59,428,163	\$ 67,341,712	\$ 69,297,317	\$ 69,451,441	\$ 63,500,000
SUMMARY BY PROGRAM AREA						
Access/Workforce Development	6,602,968	6,397,615	6,989,710	6,986,959	6,929,701	6,803,100
Improving Health	24,670,151	27,202,002	32,855,199	33,314,935	31,620,252	29,731,029
National Security Systems Initiative	1,628,600	2,126,300	1,983,800	2,873,500	3,036,800	3,322,600
Space Exploration and Optical Solutions	4,059,940	4,381,674	4,051,062	4,224,055	4,749,042	4,725,554
Water, Environment and Energy Solutions	8,996,196	10,302,034	11,035,632	10,838,040	11,500,234	9,703,978
UARC: Tech Launch Arizona	1,334,442	1,999,593	2,262,558	2,269,684	2,343,280	2,406,239
Regents Innovation Fund	778,359	2,098,342	3,351,273	3,976,527	4,467,092	2,000,000
ASU Polytechnic COPS	2,082,600	2,082,100	2,077,300	2,077,300	2,076,400	2,077,700
ASU West COPS	1,633,500	1,637,100	1,632,100	1,632,100	1,627,600	1,629,800
AZUN	1,069,734	1,201,403	1,103,078	1,104,218	1,101,040	1,100,000
PROGRAM AREA TOTAL	52,856,490	59,428,163	67,341,712	69,297,317	69,451,441	63,500,000
EXPENDITURES TOTAL	\$ 52,856,490	\$ 59,428,163	\$ 67,341,712	\$ 69,297,317	\$ 69,451,441	\$ 63,500,000

This page intentionally left blank.



ASU ARIZONA STATE
UNIVERSITY

This page intentionally left blank.

**ARIZONA STATE UNIVERSITY
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
FY 2012 - 2016**

	FY 2012 ACTUAL	FY 2013 ACTUAL	FY 2014 ACTUAL	FY 2014 BUDGET	FY 2015 BUDGET	FY 2016 BUDGET
REVENUE						
Carryforward	\$ 790,200	\$ 1,788,900	\$ 2,349,600	\$ 2,349,600	\$ 2,132,500	\$ -
TRIF Revenue	23,848,700	25,091,200	26,944,700	25,505,800	25,936,400	26,384,500
TOTAL REVENUE	\$ 24,638,900	\$ 26,880,100	\$ 29,294,300	\$ 27,855,400	\$ 28,068,900	\$ 26,384,500
EXPENDITURES						
OPERATING						
Personal Services	\$ 7,684,500	\$ 7,722,700	\$ 8,446,600	\$ 8,527,500	\$ 7,960,500	\$ 7,633,650
ERE	2,883,800	2,782,000	2,950,800	3,200,300	2,781,000	2,666,798
All Other Operating	6,479,000	7,362,900	8,676,200	8,058,900	8,176,900	7,841,152
TOTAL OPERATING	17,047,300	17,867,600	20,073,600	19,786,700	18,918,400	18,141,600
CAPITAL						
Building Renovation	-	-	25,500	1,000,000	1,000,000	1,000,000
Debt Service	2,086,600	2,943,600	3,353,300	3,359,300	4,446,500	3,535,400
ASU Poly/ASU West COPS	3,716,100	3,719,300	3,709,400	3,709,400	3,704,000	3,707,500
TOTAL CAPITAL	5,802,700	6,662,900	7,088,200	8,068,700	9,150,500	8,242,900
TOTAL EXPENDITURES	\$ 22,850,000	\$ 24,530,500	\$ 27,161,800	\$ 27,855,400	\$ 28,068,900	\$ 26,384,500
SUMMARY BY INITIATIVE						
National Security Systems Initiative	\$ 1,628,600	\$ 2,126,300	\$ 1,983,800	\$ 2,873,500	\$ 3,036,800	\$ 3,322,600
Improving Health	13,974,400	14,877,300	17,931,000	17,527,500	16,916,500	16,614,400
Water, Environ and Energy Solutions	3,530,900	3,807,700	3,537,600	3,745,000	4,411,600	2,740,000
ASU Polytechnic COPS	2,082,600	2,082,100	2,077,300	2,077,300	2,076,400	2,077,700
ASU West COPS	1,633,500	1,637,100	1,632,100	1,632,100	1,627,600	1,629,800
TOTAL EXPENDITURES	\$ 22,850,000	\$ 24,530,500	\$ 27,161,800	\$ 27,855,400	\$ 28,068,900	\$ 26,384,500

ARIZONA STATE UNIVERSITY
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
IMPROVING HEALTH FOCUS AREA

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	13,974,400	14,877,300	17,931,000	17,931,000	16,916,500	16,614,400
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	54,537,411	61,184,668	67,217,416	75,000,000	85,000,000	98,000,000
Gifts & Other Sources	40,505	390,000	2,245,202	40,000	40,000	40,000
Royalty Income	821,889	156,201	1,068,587	800,000	800,000	800,000
TOTAL	55,399,805	61,730,869	70,531,205	75,840,000	85,840,000	98,840,000
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	45	70	41	80	85	95
US Patents Issued	-	5	13	5	6	6
Licenses and Options Executed	13	29	26	15	17	18
Startup Companies	2	1	1	1	1	1
WORKFORCE CONTRIBUTION						
Academic and Postdoctoral Appointees	38	155	119	95	135	175
Graduate Students	111	87	80	110	110	110
Undergraduate Students	73	90	70	70	70	70

ARIZONA STATE UNIVERSITY
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
NATIONAL SECURITY SYSTEMS FOCUS AREA

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	1,628,600	2,126,300	1,983,800	1,983,800	3,036,800	3,322,600
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	12,618,000	23,010,570	34,269,118	33,000,000	45,000,000	70,000,000
Gifts & Other Sources	-	-	-	10,000	10,000	10,000
Royalty Income	128,250	82,500	1,265,956	350,000	555,000	725,000
TOTAL	12,746,250	23,093,070	35,535,074	33,360,000	45,565,000	70,735,000
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	9	7	32	20	25	30
US Patents Issued	-	3	13	1	1	2
Licenses and Options Executed	2	3	28	3	3	4
Startup Companies	-	-	-	-	-	-
WORKFORCE CONTRIBUTION						
Academic and Postdoctoral Appointees	-	6	15	15	23	25
Graduate Students	17	40	23	20	20	20
Undergraduate Students	-	8	8	5	5	5

ARIZONA STATE UNIVERSITY
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
WATER, ENVIRONMENTAL AND ENERGY SOLUTIONS FOCUS AREA

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	3,530,900	3,807,700	3,537,600	3,537,600	4,411,600	2,740,000
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	12,122,712	12,392,507	14,598,426	14,000,000	17,000,000	17,000,000
Gifts & Other Sources	-	-	-	25,000	25,000	25,000
Royalty Income	252,018	184,720	55,018	375,000	475,000	610,000
TOTAL	12,374,730	12,577,227	14,653,444	14,400,000	17,500,000	17,635,000
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	-	1	8	10	11	12
US Patents Issued	1	4	2	3	4	4
Licenses and Options Executed	3	1	8	9	12	12
Startup Companies	-	-	-	-	-	1
WORKFORCE CONTRIBUTION						
Academic and Postdoctoral Appointees	7	17	11	15	20	20
Graduate Students	36	77	49	35	35	35
Undergraduate Students	13	78	23	15	15	15



**NORTHERN ARIZONA
UNIVERSITY**

This page intentionally left blank.

**NORTHERN ARIZONA UNIVERSITY
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
FY 2012 - 2016**

	FY 2012 ACTUAL	FY 2013 ACTUAL	FY 2014 ACTUAL	FY 2014 BUDGET	FY 2015 BUDGET	FY 2016 BUDGET
REVENUE						
Carryforward	\$ 1,630,638	\$ 1,821,191	\$ 1,566,408	\$ 1,525,243	\$ 401,021	\$ -
TRIF Revenue	11,157,019	11,492,061	12,698,200	12,348,200	12,216,200	12,438,500
TOTAL REVENUE	\$ 12,787,657	\$ 13,313,252	\$ 14,264,608	\$ 13,873,443	\$ 12,617,221	\$ 12,438,500
EXPENDITURES						
OPERATING						
Personal Services	\$ 4,630,588	\$ 5,337,771	\$ 6,113,394	\$ 6,259,701	\$ 5,461,335	\$ 5,313,732
ERE	1,497,041	1,684,731	1,946,342	2,046,654	1,843,848	1,862,342
All Other Operating	1,641,711	3,960,958	3,477,778	3,097,448	2,990,438	2,774,726
TOTAL OPERATING	7,769,340	10,983,460	11,537,514	11,403,803	10,295,621	9,950,800
CAPITAL						
Building Renovation	-		1,391,156	90,000	640,000	80,000
Debt Service	1,344,390	263,384	434,917	880,000	680,000	1,098,556
Equipment Acquisition	962,046			999,640	501,600	809,144
AZUN	500,000	500,000	500,000	500,000	500,000	500,000
TOTAL CAPITAL	2,806,436	763,384	2,326,073	2,469,640	2,321,600	2,487,700
TOTAL EXPENDITURES	\$ 10,575,776	\$ 11,746,844	\$ 13,863,587	\$ 13,873,443	\$ 12,617,221	\$ 12,438,500
SUMMARY BY INITIATIVE						
Access/Workforce Development	\$ 6,602,968	\$ 6,397,615	\$ 6,989,710	\$ 6,986,959	\$ 6,929,701	\$ 6,803,100
AZUN	1,069,734	1,201,403	1,103,078	1,104,218	1,101,040	1,100,000
Improving Health	1,253,436	2,130,689	2,281,436	2,974,791	2,293,240	2,267,700
Water, Energy, Environmental Solutions	1,649,638	2,017,137	3,489,363	2,807,476	2,293,240	2,267,700
TOTAL EXPENDITURES	\$ 10,575,776	\$ 11,746,844	\$ 13,863,587	\$ 13,873,444	\$ 12,617,221	\$ 12,438,500

NORTHERN ARIZONA UNIVERSITY
WEES and IMPROVING HEALTH

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	10,775,776	11,746,844	13,863,587	13,873,443	12,617,221	12,438,500
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	14,105,945	11,848,074	17,711,283	15,256,990	15,867,270	16,501,960
Gifts & Other Sources	1,500,000	0	0	40,000	50,000	50,000
Intellectual Property Income	22,276	29,299	32,075	21,100	22,000	23,100
TOTAL	15,628,221	11,877,373	17,743,358	15,318,090	15,939,270	16,575,060
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	17	18	24	21	24	25
US Patents Issued	1	2	3	2	3	3
Licenses and Options Executed	1	0	1	4	4	5
Startup Companies	1	0	1	2	2	1
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	11	17	22	15	15	18
Graduate Students	92	44	187	120	125	130
Undergraduate Students	200	251	233	240	250	250

ACCESS/WORKFORCE DEVELOPMENT/E-LEARNING

PERFORMANCE MEASURE	ACTUALS FY12	ACTUALS FY13	ACTUALS FY14	BUDGET FY14	BUDGET FY15	BUDGET FY16
RETURN ON INVESTMENT (ROI)						
Annual impact of Graduates on Economy ¹	\$10.4M	\$11.3 M	\$12.4 M	\$12.4 M	\$13.5 M	\$14.7 M
TECHNOLOGY TRANSFER/CURRICULUM INNOVATIONS						
Web/Hybrid/Enhanced Courses Developed ²	141	506 ^{2a}	612	155	180	200
Faculty Developing Courses ³	265	420	485	250	300	350
Increase in Student Technology Literacy ⁴	4,122	2,676	7,108	3,800	4,000	4,200
Degree/Certificate Programs Offered ⁵	49	48	46	46	49	52
INDUSTRY OUTREACH						
Business/Nonprofit Collaborations ^{6,A}	203	263	298	125	140	155
WORKFORCE CONTRIBUTIONS						
Number of Student Served by AW/D ⁷	3,772	3,616	3,695	3,681	4,013	4,374
PARTNERSHIPS/COLLABORATIONS						
Community College/NAU Students ⁸	3,077	3,444	4,573	4,359	4,751	5,179
Community College to NAU Programs ^{9,B}	71	79	85	95	97	99

¹ Estimated based on U.S. Census Bureau Data for annual increase in earnings by a baccalaureate-trained worker compared to high school degree starting in FY12

² Includes Web, hybrid, IT-enhanced, redesigns and quality review process compliance.

^{2a} Reflects correction to FY13 Actuals

³ The number of faculty participating in course development, design and redesign.

⁴ Number of students completing a course with significant or advanced technical fluency skills.

⁵ Number of degrees supported by TRIF A/WD funding.

⁶ Organizations (business, industry, nonprofits, school districts) with formal or informal relationships with Northern Arizona University related to TRIF A/WD

⁷ Reporting based on number of students eligible to enroll in programs supported by A/WD funding.

⁸ Number of new students participating in the Northern Arizona University joint admissions or who transfer from a community college to NAU.

⁹ Program paths for a student to seamlessly transition from a given community college to NAU.

^A Variance between projected and actual number of collaborations reflects an increased focus on outreach and recruitment efforts.

^B Variance between projected and actual programs due to the recategorization of Bachelor of Arts in Liberal Studies (BAILS) degrees to Bachelors of

This page intentionally left blank.



 THE UNIVERSITY
OF ARIZONA

This page intentionally left blank.

THE UNIVERSITY OF ARIZONA
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
FY 2012 - 2016

	FY 2012 ACTUAL	FY 2013 ACTUAL	FY 2014 ACTUAL	FY 2014 BUDGET	FY 2015 BUDGET	FY 2016 BUDGET
REVENUE						
Carryforward	\$ -	\$ 1,476,104	\$ 1,795,547	\$ 1,795,547	\$ 2,065,828	\$ -
TRIF Revenue	20,128,459	21,371,920	23,235,333	21,796,400	22,232,400	22,677,000
TOTAL REVENUE	\$ 20,128,459	\$ 22,848,024	\$ 25,030,880	\$ 23,591,947	\$ 24,298,228	\$ 22,677,000
EXPENDITURES						
OPERATING						
Personal Services	\$ 6,711,059	\$ 7,576,482	\$ 8,990,322	\$ 9,753,113	\$ 10,074,640	\$ 9,445,734
ERE	2,013,928	2,600,007	2,974,069	3,638,339	4,022,222	3,404,977
All Other Operating	6,527,242	7,735,988	6,500,657	5,700,491	5,701,366	6,826,289
TOTAL OPERATING	15,252,229	17,912,477	18,465,048	19,091,943	19,798,228	19,677,000
CAPITAL						
Building Renovation	400,126	140,000				
Debt Service	3,000,000	3,000,000	4,500,004	4,500,004	4,500,000	3,000,000
TOTAL CAPITAL	3,400,126	3,140,000	4,500,004	4,500,004	4,500,000	3,000,000
TOTAL EXPENDITURES	\$ 18,652,355	\$ 21,052,477	\$ 22,965,052	\$ 23,591,947	\$ 24,298,228	\$ 22,677,000
SUMMARY BY INITIATIVE						
Improving Health	\$ 9,442,315	\$ 10,194,012	\$ 12,642,763	\$ 12,812,644	\$ 12,410,512	\$ 10,848,929
Space Exploration and Optical Solutions	4,059,940	4,381,674	4,051,062	4,224,055	4,749,042	4,725,554
Water, Environmental and Energy Solutions	3,815,658	4,477,197	4,008,669	4,285,564	4,795,394	4,696,278
Tech Launch Arizona (UARC)	1,334,442	1,999,593	2,262,558	2,269,684	2,343,280	2,406,239
TOTAL EXPENDITURES	\$ 18,652,355	\$ 21,052,477	\$ 22,965,053	\$ 23,591,947	\$ 24,298,228	\$ 22,677,000

UNIVERSITY OF ARIZONA

TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)

IMPROVING HEALTH

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	\$ 9,442,315	\$ 10,194,012	\$ 12,642,763	\$ 12,712,644	\$ 10,801,698	\$ 10,848,929
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	\$ 57,727,313	\$ 39,332,176	\$ 50,077,598	\$ 54,000,000	\$ 54,000,000	\$ 54,000,000
Gifts & Other Sources	\$ 581,469	\$ 594,746	\$ 300,040	\$ 500,000	\$ 500,000	\$ 500,000
Royalty Income	\$ 122,429	\$ 12,500	\$ 28,500	\$ -	\$ -	\$ -
TOTAL	\$ 58,431,211	\$ 39,939,422	\$ 50,406,138	\$ 54,500,000	\$ 54,500,000	\$ 54,500,000
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	15	10	28	32	32	32
US Patents Issued	2	3	2	1	0	1
Licenses and Options Executed	4	0	8	8	9	10
Startup Companies	0	0	1	0	1	0
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	80	86	96	135	135	135
Graduate Students	179	189	244	320	320	320
Undergraduate Students	209	324	325	320	320	320

UNIVERSITY OF ARIZONA

TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)

SPACE & OPTICAL SCIENCE

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	\$ 4,059,940	\$ 4,381,674	\$ 4,051,062	\$ 4,274,898	\$ 4,576,049	\$ 4,725,554
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	\$ 49,376,201	\$ 54,965,135	\$ 45,218,973	\$ 52,000,000	\$ 57,000,000	\$ 65,000,000
Gifts & Other Sources	\$ 237,436	\$ 428,842	\$ 359,749	\$ 480,000	\$ 490,000	\$ 510,000
Royalty Income	\$ 187,572	\$ 150,777	\$ 97,056	\$ 190,000	\$ 200,000	\$ 200,000
TOTAL	\$ 49,801,210	\$ 55,544,754	\$ 45,675,778	\$ 52,670,000	\$ 57,690,000	\$ 65,710,000
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	48	37	19	52	55	60
US Patents Issued	14	9	4	17	18	20
Licenses and Options Executed	14	6	8	18	19	21
Startup Companies	2	1	1	2	3	3
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	10	10	11	11	12	12
Graduate Students	34	50	45	35	36	37
Undergraduate Students	7	18	9	8	9	9

UNIVERSITY OF ARIZONA

TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF) WATER, ENVIRONMENTAL AND ENERGY SOLUTIONS

PERFORMANCE ANALYSIS	ACTUAL FY 12	ACTUAL FY 13	ACTUAL FY 14	BUDGET FY 14	BUDGET FY 15	BUDGET FY 16
TRIF EXPENDITURES						
Total	\$ 3,815,658	\$ 4,477,197	\$ 4,008,669	\$ 4,347,539	\$ 4,518,499	\$ 4,696,278
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	\$ 26,366,576	\$ 30,024,250	\$ 46,878,228	\$ 21,800,000	\$ 22,500,000	\$ 23,100,000
Gifts & Other Sources	\$ 3,433,880	\$ 3,676,766	\$ 3,267,587	\$ 3,500,000	\$ 3,600,000	\$ 3,800,000
Royalty Income	\$ -	\$ -	\$ 15,000	\$ -	\$ 300,000	\$ 500,000
TOTAL	\$ 29,800,456	\$ 33,701,016	\$ 50,160,815	\$ 25,300,000	\$ 26,400,000	\$ 27,400,000
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	19	21	26	10	10	10
US Patents Issued	2	2	1	2	2	3
Licenses and Options Executed	1	1	4	4	7	7
Startup Companies	1	1	1	0	1	1
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	87	49	41	75	80	85
Graduate Students	321	314	255	250	260	270
Undergraduate Students	122	85	99	100	110	120



EDUCATE • DISCOVER • IMPACT

This page intentionally left blank.

**ABOR SYSTEM OFFICE
TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
FY 2012 - 2016**

	FY 2012 ACTUAL	FY 2013 ACTUAL	FY 2014 ACTUAL	FY 2014 BUDGET	FY 2015 BUDGET	FY 2016 BUDGET
REVENUE						
Carryforward	\$ 721,871	\$ 2,065,554	\$ 1,976,527	\$ 1,976,527	\$ 2,467,092	\$ -
TRIF Revenue	2,122,042	509,315	3,841,837	2,000,000	2,000,000	2,000,000
TOTAL REVENUE	\$ 2,843,913	\$ 2,574,869	\$ 5,818,364	\$ 3,976,527	\$ 4,467,092	\$ 2,000,000
EXPENDITURES						
OPERATING						
Personal Services	\$ 88,971	\$ 131,300	\$ 129,656	\$ 131,300	\$ 131,300	\$ 131,300
ERE	27,555	37,315	36,904	39,400	39,400	39,400
All Other Operating	1,840	6,678	6,633	79,300	79,300	79,300
TOTAL OPERATING	118,366	175,293	173,193	250,000	250,000	250,000
GRANTS/PROJECTS						
Pass Through to Universities			1,750,000	1,500,000		
Regents Innovation Fund	659,993	1,923,049	1,428,080	1,726,527	1,941,824	1,250,000
Other				500,000	2,275,268	500,000
TOTAL GRANTS/PROJECTS	659,993	1,923,049	3,178,080	3,726,527	4,217,092	1,750,000
TOTAL EXPENDITURES	\$ 778,359	\$ 2,098,342	\$ 3,351,273	\$ 3,976,527	\$ 4,467,092	\$ 2,000,000
SUMMARY BY INITIATIVE						
Pass Through to Universities			1,750,000	1,500,000		
Regents Innovation Fund:						
Center for the Future of Arizona	225,000	325,000				
HRAA/CTSA	325,000					
National Student Clearinghouse	49,302	49,869	48,427	50,000	50,000	50,000
Collaboration				310,707	510,707	200,000
SciVal		202,000				
Graduate Research Grants		230,000				
IT Research (ABOR)		16,180	54,980	83,820	28,840	
Wastewater Mass Culture		200,000				
Digital Research		450,000				
AEGIS		450,000				
Regent Innovation Fund Grants			1,231,950	1,232,000	1,941,824	1,000,000
Other	60,691		92,723	550,000	1,685,721	500,000
TOTAL EXPENDITURES	\$ 659,993	\$ 1,923,049	\$ 3,178,080	\$ 3,726,527	\$ 4,217,092	\$ 1,750,000

This page intentionally left blank.

**Arizona Board of Regents
2020 North Central Avenue, Suite 230
Phoenix, AZ 85004
602-229-2500
www.azregents.edu**