TECHNOLOGY AND RESEARCH INITIATIVE FUND

FY 2015 Annual Report

September 1,2015

As required by A.R.S. § 15-1648 (D)

EDUCATE · DISCOVER · IMPACT

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

For the Fiscal Year Ended June 30, 2015

TABLE OF CONTENTS

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TRIF Executive Summary

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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.

- 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 2014-15, TRIF received approximately $68.4 million in revenue. The projected revenue for FY 2012-2016 is approximately $306.5 million. Total TRIF revenue received to date since the inception of the program in June 2001 is $823 million.

- The TRIF statute includes a 20 percent limitation on use of TRIF funds for capital projects expenditures.

2015 FINANCIALS

This year ABOR received $6,053,497 in excess of the TRIF revenue anticipated budgets. These excess funds were distributed to the three universities in August and are reflected as "carry forward" amounts in their financials.

(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 31, 2015


ASU
ARIZONA STATE
UNIVERSITY

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Technology and Research Initiative Funds (TRIF) have had a tremendous impact at Arizona State University (ASU) in supporting our rapid growth in research, entrepreneurship and economic development activities and returning significant benefits to Arizona citizens and our economy. By investing in three strategic focus areas, we continue to effectively apply our expertise and translate research into new technologies that have real marketplace impact. We are graduating a number of highly skilled students that positively impact Arizona's workforce, launching new businesses based on technology developed at ASU, and attracting companies to Arizona.

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

- **Improving Health** encompasses use-inspired, collaborative research that advances human health and quality of life.
- **National Security Systems** addresses the critical research and technology of 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, food and clean air.

We have garnered several achievements in each of these focus areas. In the past year we have secured millions of dollars of external funding from new and existing sponsors. We have launched research centers to establish Arizona as a leader and in anticipation of new funding opportunities and changes in the marketplace. We have recruited world-class faculty and attracted leaders from around the world to further strengthen our expertise and establish our unique approach. ASU is excited to provide high-value returns on TRIF investments for Arizona citizens. We are pleased to share this summary of accomplishments enabled by TRIF over the past year.

"At ASU, TRIF investments provide a foundation from which innovation and discovery are launched. From expanded lab space and equipment to new research centers and collaboration, TRIF enables our researchers to work at their full potential and expand their impact. This translates to our continued engagement in use-inspired, multidisciplinary research and our growing reputation as a world-class research university."

– Sethuraman Panchanathan,
Senior Vice President of Knowledge Enterprise Development

IMPROVING HEALTH

TRIF-enabled researchers are developing innovative approaches to the complex challenges of health and health care. Their efforts range from understanding the human body at the molecular level to identifying and preventing disease, to harnessing the power of games to improve health, to developing computing resources that can rapidly process terabytes of data to advance informatics-driven research in areas such as personalized medicine.

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

- The ***Biodesign Institute*** impacts today's critical global challenges in health care, sustainability and security by developing solutions inspired by natural systems and translating those solutions into commercially viable products and clinical practices.
- ***Complex Adaptive Systems*** (CAS) represents a unique framework for biomedicine. The group collaborates broadly within ASU and with major institutions globally. Initiatives led by CAS include the National Biomarker Development Alliance (NBDA) and CAS Biomedicine, which works on models and analytics to integrate big data in biomedicine. NBDA currently collaborates with leaders from over 100 U.S. and international institutions.
- 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 with a focus on issues related to health and learning.
- The ***Advanced Computing Center*** (A2C2) is a unique, high-performance computing resource leveraged across the three TRIF focus areas. A2C2 allows ASU to place our researchers at the forefront of advanced computing. The processing capacity of A2C2 allows ASU researchers, industry partners and community leaders to collect, manage and analyze vast and complex data sets in order to rapidly discover strategies and produce real-world outcomes in all research disciplines supported by TRIF.

"This past year demonstrated the potential of TRIF investment to have a profound local, state and world impact. The extraordinary and brilliant achievements of scientists like Charles Arntzen have put Arizona on the map. The State of Arizona has received significant return on its TRIF investment in Biodesign from its scientific breakthroughs, spinout successes, and key contributions to the economic impact and job growth in the biosciences."

– Raymond DuBois, director of the Biodesign

Summary of Accomplishments

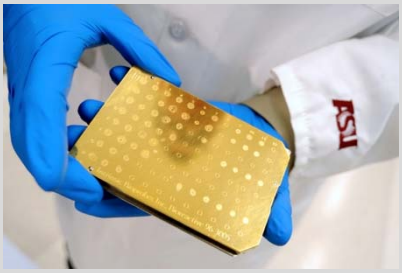
Each year TRIF investments in the area of Improving Health are leveraged to secure new external funding awards and to expand our portfolio of research and technology for maximum impact.

Results – Impact

- The Biodesign Institute has made an **economic impact of $1.5 billion** since it was established 10 years ago. Its annual direct economic impact is the highest for any single bioscience research institute in the state. Biodesign operations have created and supported **more than 1,600 high-paying jobs** and generated **$10.5 million in state and local tax revenues.**
- Biodesign researchers are using a pioneering X-ray crystallography technique with unprecedented potential for **drug development and bioenergy applications**. Researchers also developed a prototype DNA reader that could make **whole genome profiling** an everyday practice. The institute is further expanding its reach through a new alliance with Banner Health, the **ASU-Banner Neurodegenerative Disease Research Center.**
- In addition to **expanding its processing and storage capacity** to serve additional researchers, A2C2 has **established a tri-university collaborative partnership** with the University of Arizona and Northern Arizona University to showcase Arizona as a regional high-performance computing hub and to shape the agenda to meet the needs of sponsors and researchers.
- Through NBDA, CAS is implementing the first-ever **national standards for personalized medicine** with the College of American Pathologists**.** In addition, the initiative is commencing **trials using biomarkers to change the course of diagnosis and treatment of the most common form of adult brain cancer.**
- The Center for Games and Impact secured **numerous external funding awards** for projects based on their Journey platform, an innovative approach to online learning platforms. These include an award from the National Science Foundation for impact-based research methodologies. Mayo Clinic has also expressed interest in creating **game-infused curricula focused on empowering patients**.

"The aging of the U.S. population and associated increases in complex diseases represents a looming health care and economic crisis. The convergence of the knowledge needed from all stakeholders to identify solutions to these daunting problems often require trans-sector networks and innovative approaches that are made possible through transformative TRIF investment at ASU."

– Anna Barker, co-director, CAS; director, NBDA



NATIONAL SECURITY SYSTEMS

ASU takes a multi-faceted approach to security that includes deep public-private partnerships between the university, industry and government and prominently positions ASU with other major public and private institutions to help solve the world's greatest challenges.

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

- The ***Global Security Initiative*** (GSI) has replaced the Security and Defense Systems Initiative and tackles "wicked problems" characterized by challenges with complex interdependencies without obvious solutions. This initiative explores issues at the intersection of climate security, cybersecurity, data and analytics security, and human security.
- The ***Space Technology and Science Initiative*** (NewSpace) leverages ASU's expertise in space-related science, technology and operations to build the future of America's commercialized space programs. NewSpace is developing partnerships with companies in Arizona and the Southwest, where private commercial spaceports and rocket factories are increasingly becoming an integral part of the space landscape.
- The ***Flexible Electronics and Display Center*** (FEDC) is a global leader in flexible electronics manufacturing. This public-private partnership demonstrates ASU's manufacturing capabilities and has created a powerful innovation infrastructure to drive economic growth. Together with the ***MacroTechnology Works Initiative*** (MTWI), ASU is advancing fundamentally new manufacturing capabilities for emerging transformational technologies including, but not limited to, large-area and flexible hybrid electronics.

"'Wicked problems' – complex, difficult to understand, possibly with no solution – are at the heart of many national and global security issues. Climate, energy, cybersecurity and the spread of infectious disease are all examples of 'wicked problems.' GSI, designed and founded with TRIF, empowers us to think differently and drive progress."

– Jamie Winterton, Director of Strategic Initiatives, GSI

Summary of Accomplishments

This focus area has achieved high-dollar external funding awards, partnerships with new agencies and private companies, and the creation of innovative technology.

Results – Impact

- GSI secured an award of **$20 million from the National Geospatial Intelligence Agency** to establish the Foresight Initiative, a cooperative partnership led by ASU that will examine the security risks associated with climate change. More recently, GSI **established the Center for Cybersecurity and Digital Forensics**. These new initiatives have created important strategic relationships with the Department of Energy National Labs underpinned by new MOUs and collaborative strategic plans for joint initiatives.
- NewSpace director Jim Bell was selected to oversee the **design and development of the panoramic color zoom cameras for NASA's Mars 2020 Rover**. The images captured by the cameras will bring new understanding about the Red Planet. In addition, NewSpace director of research Craig Hardgrove was awarded **$900,000 from NASA for the development of a neutron detector**.
- FEDC designed and delivered a **10.2-inch flexible X-ray detector**, the first of its kind, to the Defense Threat Reduction Agency. The center also demonstrated a **flexible optical heart rate monitor**.
- FEDC and MTWI **secured a highly competitive planning grant of $500,000** (one of 18 nationwide) to prepare a proposal for the National Institute of Standards and Technology Advanced Manufacturing Program. ASU is also positioned to **be highly competitive for a $75 million** Flexible Hybrid Electronics Manufacturing Institutes Initiative award that will be announced in the coming fiscal year.

"With TRIF funding, the NewSpace Initiative has been able to strengthen and broaden relationships with key emerging aerospace companies for collaborative research and educational opportunities."

-Jim Bell, director of NewSpace Initiative

WATER, ENVIRONMENTAL AND ENERGY SOLUTIONS

ASU researchers are addressing critical issues associated with an increasingly urbanized and resource-constrained world, developing solutions that are being implemented around the world.

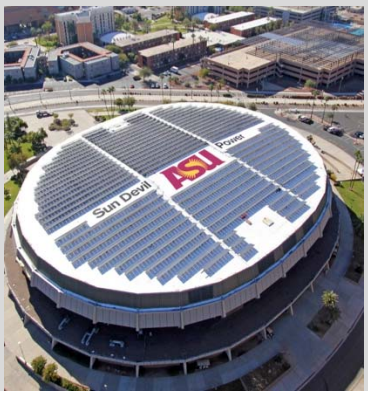
Programs supported in the Water, Environmental and Energy Solutions focus area and associated goals:

- 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 ***Julie Anne Wrigley Global Institute of Sustainability*** (ASU Wrigley Institute) advances research, education and business practices for an urbanizing world. Its four cornerstones of education, research, business practices and global partnerships, and transformation transcend disciplines, campuses and institutional boundaries.
- 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 provides LightWorks the means of strategically connecting ASU's light-inspired projects with other organizations: seeking collaborative research proposals, providing a venue to share best practices, connecting faculty with funding opportunities and projects with industry, furthering ASU's zero emission goals, and positively impacting communities in Arizona and across the globe.

LightWorks' ability to pursue and win grants and develop leading-edge technology and ideas relies entirely on TRIF support. Since its inception, LightWorks has leveraged $11 million in TRIF support to win more than $90 million in grant funding."

– Gary Dirks, director of LightWorks



Summary of Accomplishments

Programs in the Water, Environmental and Energy Solutions portfolio operate at local and global scales to address issues of sustainability.

Results – Impact

- LightWorks has leveraged TRIF funds to broaden international ties, secure external funding, and expand research and collaboration to advance technology innovations. For example, **partnerships with Mexico's UNAM University and Mexico's Electrical Research Institute** strengthen ties between international borders. New studies published by LightWorks faculty provide insight into the **environmental and economic benefits of solar shade structures**.
- DTN provided interactive decision space and analyses that supported several prominent achievements. These include the **Human Trafficking Awareness event led by Cindy McCain** that was attended by members of the government and law enforcement as well as from the media; completing the **Mexican Energy model** that coordinates oil and gas investment efforts in Mexico; and analysis and visual displays that will **support planning and development in disadvantaged communities in South Phoenix** in partnership with Raza Development Fund.
- The ASU Wrigley Institute delivered **training to World Bank Executives** through the Sustainability Education and Training Group, **expanded the Green Growth Program** through presentations at a transcontinental conference, and developed workshops and an ASU course: Climate Related Risks. Models and tools developed by Green Growth researchers provided a **green growth guide for climate and energy policies in Europe**. The new Food Systems Transformation Initiative hosted "Innovations in Sustainable Food Systems: Improving Youth Engagement and Entrepreneurship on the Farm and Beyond," which **attracted 67 participants**. A new virtual center, Food Systems Sustainability Hub, will focus on **impacting food systems to create positive change** in surrounding communities and around the world.

"In 2015, TRIF funding enabled the School of Sustainability to engage the World Bank and International Finance Corporation for a two-day workshop on climate change, sustainability and investment in the developing world. Thirty executives from the World Bank Group traveled to Tempe for an exchange with a dozen of ASU's premier sustainability faculty and local business leaders."

– Chris Boone, dean of the School of Sustainability

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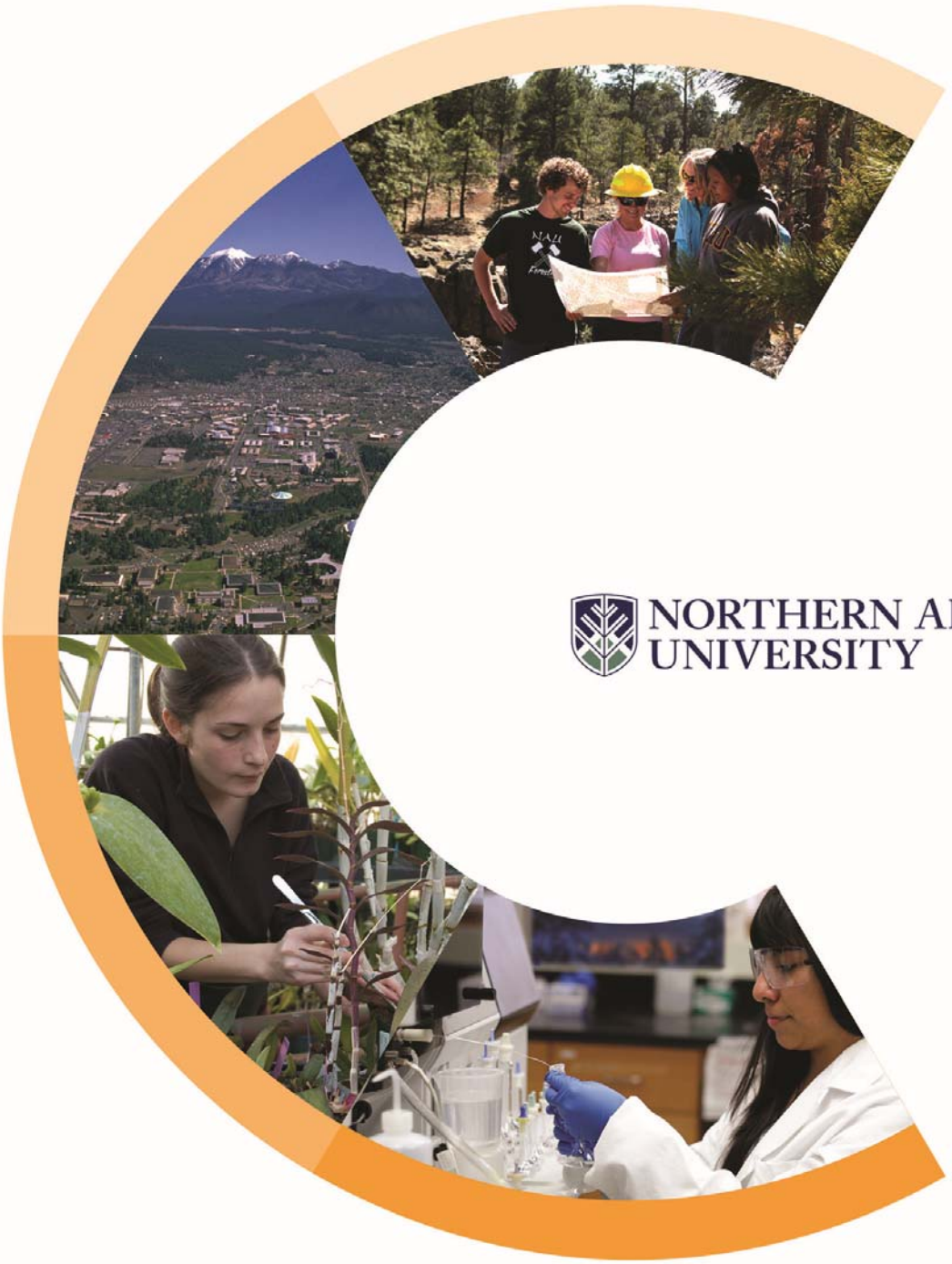

NORTHERN ARIZONA UNIVERSITY

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The three initiatives under Northern Arizona University's TRIF Business Plan continue to generate a positive return on investment. Since the Arizona Board of Regents approved the FY12-FY16 plan in spring 2011, **Water, Energy and Environmental Solutions (WEES), Improving Health (iHealth)** and **Access and Workforce Development (AWD)** have demonstrated the resonance and reach of NAU's research strengths.

The financial impact of the university's TRIF investments to date exceeded our FY15 goal by 35% and exceeded our FY14 performance by more than 20%. The non-financial returns are just as impressive. For example, the Center for Ecosystem Science and Society in FY15 alone attracted five times as much in external funding as all the TRIF funds invested in the center to date.

In FY15, NAU invested TRIF funds across these noted initiatives in strategic ways. We continued to invest in the Informatics and Computing Program by providing start-up funds to attract new, research-intensive faculty and by adding capacity to the university's high performance computing cluster, Monsoon. The combination of these investments resulted in a stronger research and institutional partnership with Northern Arizona Healthcare (parent company of Flagstaff Medical Center) demonstrated by a jointly funded faculty position in healthcare informatics. A new Center for Bioengineering Innovation was established this year and has already attracted high-productivity researchers from other institutions, faculty with backgrounds in private sector bioengineering, and helped secure a prestigious $1 million award from the W.M. Keck Foundation. The university's Extended Campuses division invested TRIF funds in the development of a new pathway tool designed to help community college faculty and staff better assist students transferring to NAU under our 2NAU joint admission partnerships.

NAU's historical strength in environmental and climate sciences, 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. The university's AWD initiative supports the state's economic growth through the development and delivery of courses and degree programs that support workforce development in high demand areas like health, teacher education, and business and nonprofit management.

"Northern Arizona University's TRIF investments have enabled us to build upon key research strengths in microbiology, ecosystem science, forest and water research, and bioengineering in ways that return economic benefit to the citizens and businesses of the State of Arizona. **TRIF funding has been a major catalyst for intellectual property development, technology transfer, and workforce development in critical high-demand fields.** Through these and other strategic TRIF investments, NAU makes important contributions to the communities of northern Arizona and throughout the state."

William "Bill" Grabe
Vice President for Research

"Catastrophic wildfire is one of the biggest natural resource issues facing Arizona and the west. **TRIF investments in the Ecological Restoration Institute have accelerated research on forest restoration treatments that lower fire risk, restore forests, protect water supplies and water delivery infrastructure, improve habitat, create rural jobs, and support rural communities.** TRIF-funded research has been essential for enhancing and protecting the amenities that are so important to the quality of life in Arizona."

W. Wallace Covington

WATER, ENERGY & ENVIRONMENTAL SOLUTIONS (WEES)

Northern Arizona University manages two programs under the TRIF WEES initiative. Both of these programs—**"Climate and Energy Solutions"** and **"Solutions for Arizona's Rural Landscapes"**— are based on the understanding that Arizona's natural resource base drives the viability of key economic activities of tourism, farming, ranching and recreation. Through rigorous scientific research, sound scientific and technical assistance, and information transfer to landowners, managers, and stakeholders, NAU's efforts under the WEES initiative contributes towards minimizing the risks of catastrophic wildfires and rebuilding a strong forest products economy in Arizona, maintaining affordable and secure water resources across the state, and resolving multiple-use conflicts through collaborative planning and analysis.

Goals

- **Ecological Restoration Institute (ERI).** Provide leadership to develop solutions to the costly environmental problem of degraded forest health, water quality, and availability of 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 (LCI).** 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. Forge new solutions to environmental challenges through applied biological science, collaborative planning and field-based training.
- **Ecosystem Science and Society Center (Ecoss).** Conduct research on ecosystems—from the cell to the globe—and investigate how they respond to and shape environmental change. Train future scientists, and communicate discoveries to the public.
- **Merriam-Powell Center for Environmental Research (MPCER).** 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.

Hundreds of thousands of acres on the Coconino National Forest are slated for thinning during the next 20 years. **NAU researchers want the forest restoration efforts to result in better water quality and quantity**, a shift that could reduce wildfire risk, prevent post-fire flooding and save cities money in water treatment costs. *Above: Post-doctoral scholar Frances O'Donnell installs soil moisture probes in the forest.*

Courtesy of NAU

Professor Bruce Hungate, director of Ecoss, investigates how other types of bacteria influence staph bacteria. "When we are looking at medical infections from an ecological perspective, it is important to consider the number of organisms, the different kinds that are present and the way they interact," Hungate said. **"By understanding and monitoring the organisms that hurt staph, we can effectively design treatments for this pathogen."** The work was collaborative with scientists from Johns Hopkins University, George Washington University, Denmark, and TGen North, and was published recently in *Science Advances*.

Summary of Accomplishments

Northern Arizona University's investments under the TRIF Water, Energy and Environmental Solutions (WEES) initiative demonstrated financial return and impact in FY2015 through research innovation, new research partnerships and increased research capacity that will ultimately stimulate economic activity across the state.

Results – Impact

- Northern Arizona University faculty who have received TRIF funds through the WEES initiative were awarded over $14 million in new external grants in FY2015.
- The Ecological Restoration Institute (ERI) received $205,000 from the Arizona Super Bowl Host Committee and the NFL Foundation as part of the community campaign for Super Bowl XLIX, which took place in Glendale in 2015. The grant will help ERI leverage existing funds from the Salt River Project and other sources to continue work on the long-term effects of forest restoration on watershed health.
- Associate professor of Forestry Kristen Waring received the largest forestry research grant in NAU history--$4.1 million—to study the threatened southwestern white pine. Dr. Waring's was the only proposal funded out of the 50 submitted to the National Science Foundation under this program. The project is a collaboration between NAU, Oregon State and Virginia Commonwealth Universities.
- Northern Arizona University's Merriam-Powell Center for Environmental Research received a three-year, $720,000 grant from the National Science Foundation to examine the persistent effects of invasive Scotch broom on the survival and growth of Douglas fir trees, an economically important Pacific Northwest species. In addition to advancing research that can be applied to an important problem, this project will train and educate NAU students, including undergraduates, who will be involved in the field research.
- Professor Gery Allen, director of NAU's Environmental Genetics and Genomics Laboratory, received a five-year, $2.5 million grant to examine how environmental change and invasive species will affect Fremont cottonwood trees, a "foundation species" of the Southwest's rapidly vanishing stream-side habitats. The findings from this study will be used to identify the genetic lines that can best cope with environmental change and to develop more effective conservation strategies.
- Professor Ted Schuur, professor of Biological Sciences in the Center for Ecosystem Science and Society, received a $775,000 award from the National Science Foundation as part of a multi-million dollar Study of Environmental Arctic Change (SEARCH). Schuur, recruited to NAU in 2014 under NAU's WEES initiative, leads the SEARCH Permafrost Action Team, a group supporting activities developed by the Permafrost Carbon Research Network. The SEARCH project will generate new knowledge through science synthesis while also facilitating connections with stakeholders and policy makers.

Kristen Waring, associate professor of Forestry, leads a tri-university study of how south-western white pine trees are affected by white pine blister rust disease, a disease caused by *E. ribicola*—an invasive species of fungus that was introduced into North America in the early 1900s. **The deadly fungus has caused severe damage to the southwestern white pines in New Mexico and has now made its way into eastern Arizona.** "This project brings together a lot of issues facing the white pine and other tree species today", Waring said. The work is important for land managers and agencies across the Southwest.

IMPROVING HEALTH: INVESTING IN BIOTECHNOLOGY AND BIOENGINEERING

Northern Arizona University's mission under the iHealth initiative is to strengthen and expand Arizona's biosciences economy by building increased research capacity in the biosciences/bioengineering and health research, and by translating the resulting discoveries and new knowledge into economic activity through technology transfer.

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 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.

The challenges of walking over a variety of natural surfaces reveal just some of the complications of designing a bionic body part, such as an ankle, that functions even remotely as well as the real thing. However, researchers in the NAU Center for Bioengineering Innovation (CBI), under the direction of Regents' Professor of Biological Sciences Kiisa Nishikawa, may have formulated a solution to more seamlessly integrate natural movement into mechanical support. **"We believe [our] algorithm is a major breakthrough towards creating a foot/ankle prosthetic for all-terrain walking"**, said Nishikawa. "We were able to show that our algorithm works not only during level walking at variable speed but also going up and down stairs and walking backward." In robotics, such a do-all algorithm is known as robust control, Nishikawa said. "With minimal information, it can respond in the appropriate way in all terrains and in a variety of circumstances".

Courtesy of NAU News

Summary of Accomplishments

In FY15, researchers and research centers receiving TRIF funding under the iHealth initiative demonstrated their ability to leverage NAU's TRIF investments in ways that generated externally sponsored research dollars, new partnerships with research performing institutions, and valuable, intensive research opportunities for NAU graduate and undergraduate students.

Results - Impact

- Northern Arizona University faculty who have received TRIF funds through the iHealth initiative were awarded over $7 million in new external grants in FY2015.
- Northern Arizona University and Northern Arizona Healthcare (NAH), parent company of Flagstaff Medical Center, partnered in FY2015 to create a new, research-intensive faculty position in Healthcare Informatics. The new faculty position will reside in the NAU Informatics and Computing Program and will work collaboratively with researchers at NAU and NAH to bridge the gap between the cutting edge research of a computer scientist and the applied, immediate needs of a major healthcare organization.
- In FY2015, Northern Arizona University and the Translational Genomics Research Institute (TGen) were awarded Patent No. US 8,808,993 B2 for a test that can detect—and assist in the treatment of—the H1N1 flu strain. The test is very effective at detecting and characterizing H1N1, which is a dominant strain in the U.S. and across the globe.
- Paul Keim, Regents' Professor of Biological Sciences and director of the Center for Microbial Genetics and Genomics, was awarded a $1.4 million grant from the Defense Threat Reduction Agency to study Burkholderia pseudomallei infection (melioidosis) in humans and animals.
- Kiisa Nishikawa, Regents' Professor of Biological Sciences, and a team of researchers in the Center for Bioengineering Innovation (CBI) received a $225,000 grant from the National Science Foundation to perfect the development and integration of an algorithm in bionic ankles. The algorithm, developed with TRIF funding, is being tested in collaboration with an industry collaborator, BiOM—a producer of "propulsion technology" to replace lost muscles and tendons. *(See sidebar on the previous page.)*
- Under the THRIVE (Translational Health Research Initiative) program, NAU partnered with Flagstaff Medical Center to develop a successful $200,000 proposal to the Flinn Foundation for a joint research project to identify how and where people in the community become infected with common germs and to guide future research efforts to prevent illness.

Stroke is the leading cause of long-term disability in the United States, affecting more than 800,000 people a year, of which more than one third are under age 65. Pam Bosch, associate professor of physical therapy, was awarded TRIF funding in FY2015 to research the role of aerobic exercise in patients recovering from stroke. **Bosch's approach may open the way for patients to experience faster recovery from stroke and realize a higher quality of life.** "My hypothesis is that basing the exercise prescription on a measure called ventilatory threshold and using an interval training protocol during treadmill walking may be an important component of rehabilitation," Bosch said.

Courtesy of NAU News

ACCESS AND WORKFORCE DEVELOPMENT (AWD)

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. The Access and Workforce Development (AWD) initiative focuses on shortages of teachers, health-care professionals, trained managers and information technology professionals. The eLearning Center (ELC), meanwhile, improves student learning and supports successful degree completion through engaging, effective and efficient use of technology. The center provides instructional design and development of technology components for new and existing courses.

Goals:

- **Continue the AWD initiative**. Make quality programs available in locations and through delivery methods that align with market demand and student need. 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 through NAU. 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.

- **Expand 2NAU participation.** Encourage community college students to identify as a University student with an objective of earning a four-year degree early in their college career. Upon starting classes at an Arizona community college, they have the opportunity to share with family and friends that they have been admitted to NAU. While attending the community college they have access to resources at both institutions. This ensures they follow the most efficient and inexpensive path to a four-year degree. Students are encouraged to persist and are eligible for a scholarship after demonstrating superior academic achievement and continuous enrollment.

- **Launch a new pathway tool.** Support community college advisors. Help community college faculty and staff understand how to help students interested in NAU is an extension of our 2NAU joint admission partnerships. The tool, scheduled to launch in August of 2015, will provide a recommended course sequence at each of the community colleges that best prepares students for NAU. The pathways maximize the number of units taken at the community college and minimize the opportunity for credits that won't count toward a degree.

"I have a full work schedule and manage a lot of community activities. I'm involved in a lot of volunteer work with veterans' organizations so I have a pretty full schedule. **The outline of the courses [through NAU's Extended Campuses] really provided me the opportunity to remain consistent in all of my personal and professional goals and still attend college."**

Daymond Howell (pictured with Shirley Begay), receiving a B.S. degree in Public Administration, December 2014

- **Continue the eLearning Center.** Provide creative design work supporting and collaborating with faculty to create engaging videos, audio recordings, animations, and other instructional media to effectively convey course concepts.

Summary of Accomplishments

Through Northern Arizona University's AWD, students are offered some of the most affordable four-year degree options in the state of Arizona. ELC works with faculty on publications and presentations, and ELC staff actively present at national venues such as the EDUCAUSE Learning Initiative and The Teaching Professor conferences.

Results - Impact

- NAU has joint admission agreements with nearly every Arizona community college, which expands its mission to provide affordable and accessible education throughout Arizona. The 2NAU joint admission program provides access to a four-year degree through seamless transition from the community college to NAU. Currently, there are 6,300 participants in the program, a 40% increase since June of 2014.
- During the past year, NAU has launched an online orientation tool to guide eligible students to the program. This online tool provides students with information about 2NAU on demand and reduces an investment of staff time (formerly delivering information to small groups of students at a time) by 1,200 hours per year. This type of efficiency ensures that 2NAU is poised to scale to serve the needs of Arizona.
- Each fall and spring anywhere from 200 -500 2NAU joint admission students begin taking classes at NAU.
- The ELC is a central university-wide faculty support unit within the Office of the Provost.
- Over the past year ELC supported 42 faculty re-envisioning and revising 32 courses as part of the President's Technology Initiative for Blended Learning. One measure of the growth in this area is that there were 23,699 enrollments in Blended courses, up from 7,108 last year.
- Across the university and around the state, ELC provided numerous workshops, consultations and hands-on support for faculty at all of our campuses. Part of that support included 372 technology training events and Instructional Design support for over 230 course revisions and redesigns.
- The ELC continues to grow support in the areas of Quality Matters (a national program for consistent and high quality online and blended course design), blended learning (especially in large enrollment courses), and implementation of a template for online and in-person courses using Blackboard shells.
- The ELC help desk now has evening and weekend hours, handling over 18,000 calls, email and walk-in requests for help (up from 13,000 last year).
- This year ELC initiated a contract with Kaltura to provide a university resource to stream media. The project is just off the ground and will provide a robust and easy to use media resource for students, faculty, staff and the entire NAU community.

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THE UNIVERSITY OF ARIZONA

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At the University of Arizona, TRIF promotes the economic development of the state by: **catalyzing innovative research** in target areas of high impact aligned with Arizona businesses; **promoting and accelerating the translation of research results** into new products and services that benefit the health, security, and prosperity of Arizona; **educating students**—from elementary to graduate school—to be science and innovation leaders who will create Arizona's bright high-technology future; and **providing infrastructure** through research and business development services, research computing, and research facilities that advances and supports innovation and research.

UA's TRIF activities fall under four initiatives:

Improving Health supports UA researchers tackling complex and pressing health problems of critical importance to Arizona and the nation, as well as major challenges in the agricultural sciences. TRIF investments allows the BIO5 Institute to bring researchers together to translate research into health solutions. **Researchers have generated $64M in new grant awards - more than a 5x return on TRIF investment**. The impact has included diverse research such as the treatment for hearing loss caused by chemotherapy and the impact of aging on asthma and HIV.

Kimberly Espy, SVP for Research

"TRIF funding enables UA to make the investments in innovation and discovery that improves the economic and public well-being of our state."

Space Exploration and Optical Solutions seeks to expand opportunities for students in optics, incubate novel research directions, and impact regional economic development by leveraging UA's world-renowned optics education and resources. **TRIF has provided critical support to extend our capabilities and has helped spark breakthroughs such as producing unprecedented images of volcanos on a Jupiter moon.** TRIF has helped in the continued success of the Center for Integrated Access Networks (CIAN) Engineering Research Center, led by Nasser Peyghambarian.

Water, Environmental and Energy Solutions (WEES) seeks solutions to Arizona's water, environmental, and energy resources challenges, with far-reaching societal benefits. The new Water and Energy Sustainable Technology (WEST) center is developing wastewater treatment and alternative energy technologies. Impact from WEES includes $36.4M in new grants, gifts and contracts. **WEES support puts scientific knowledge into action** through "DroughtView," a way to track the severity of the drought.

Tech Launch Arizona, UA's technology commercialization unit, aims to accelerate the process of **moving UA discoveries from the laboratory to the marketplace**, providing an avenue for UA research to create economic and social impacts. In FY15, TLA had a number of gains – a 13% increase in invention disclosures, a 46% increase in patents issued, and a 45% increase in revenue from royalties and patent reimbursements for intellectual property.

IMPROVING HEALTH

TRIF investments in **Improving Heath** have brought together world-class plant, animal, and human biologists, engineers, physician-scientists, and computational scientists under the auspices of BIO5 to **develop bold solutions for complex quality of life challenges** such as disease, hunger, water safety, and other environmental issues- critical challenges facing 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 across all biological disciplines in order to expedite large-scale, team science grants that will boost federal 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.

Anita Koshy, MD
Dr. Koshy received the March of Dimes Basil O'Connor Starter Scholar Research Award to further her work studying the basis for congenital brain infections as they relate to infant health.

Fernando Martinez, MD, Donata Vercelli, MD, and Shane Snyder, PhD

This transdisciplinary research team is collaborating with Johnson & Johnson Innovation to explore environmental determinants of asthma origins as a basis for novel prevention and treatment approaches.

David Galbraith, PhD
Dr. Galbraith is adapting technologies he developed to analyze plant cells for use in the early detection of human diseases such as cancer, as well as public health challenges like the Ebola virus.

Summary of Accomplishments

By leveraging TRIF, BIO5 researchers continue to push the boundaries of knowledge, facilitate cutting-edge science breakthroughs, and garner international recognition for the impact of their work. Diverse accomplishments focused on improving health and enhancing public impact include innovations such as testing a potential cure for valley fever and developing wearable technology aimed at promoting wellbeing.

The interdisciplinary and collaborative nature of BIO5 researchers has served as the foundation for more than 430 publications showcasing broad areas of discovery - including articles in *Nature, Science, New England Journal of Medicine,* and *Journal of the American Medical Association.*

Results – Impact

- BIO5 researchers have generated **$64M in new grant awards**, which is more than a five-fold return on TRIF investment
- The U.S. Food and Drug Administration fast-tracked the UA-developed drug nikkomycin Z (NikZ), with clinical trials underway in 2015. The drug is thought to be a **potential cure for valley fever**
- Dr. Abraham Jacob is partnering with private companies and industry to explore the use of zebrafish as a model organism in developing **treatments for hearing loss caused by chemotherapy**
- Drs. Monica Schmidt and Eliot Herman have created a new, naturally occurring and **low-allergenic soybean** that could have big impact on baby formula and animal feed
- Dr. Joyce Schroeder has developed a patented treatment that could **stop breast cancer metastasis**, with plans to move the drug into the human clinical trial phase within the next year
- Expanded efforts and recruits in biostatistics and bioinformatics are focused on the intersection of big data and genomics to **accelerate biomedical discoveries**
- Dr. Janko Nikolich-Zugich has formed partnerships with clinical colleagues in the department of medicine and the Arizona Respiratory Center to study the **impact of aging on asthma and HIV**
- Drs. David Armstrong, Bijan Nafafi, and Esther Sternberg are tapping the potential of **wearable technologies aimed at enhancing personal health** and wellbeing.
- A study led by Dr. Kristian Doyle found a potentially treatable cause of **dementia following stroke**.

Felicia Goodrum, PhD, and Bre Eder, UA public health undergraduate student
This unique professor/student collaboration was formed to raise awareness of the potentially deadly cytomegalovirus (CMV) and to educate those at risk on how to prevent congenital infections. The U.S. Centers for Disease Control and Prevention report that 1 in every 150 children is born with congenital CMV.

SPACE EXPLORATION AND OPTICAL SOLUTIONS

The TRIF Space Exploration and Optical Solutions initiative seeks to expand 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.**

Neal Armstrong, Regents Professor of Chemistry, Biochemistry, & Optical Sciences, and Associate Vice President for Research.

"The new Raman Reflex confocal microscope enabled by TRIF support will serve the needs of an expanding and diverse cross-section of UA faculty, students and postdocs, now numbering in excess of 40 principle investigators in 18 departments and 80 students/postdocs."

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 University and connect industry with university capacity
- Support Arizona workforce development directly through increased student fellowships and enhance the University's outreach to companies and under-represented 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

Summary of Accomplishments

FY15 investments in the TRIF Space Exploration and Optical Solutions program have generated bold new faculty research directions, unique educational opportunities for students, powerful new research infrastructure, and enhanced outreach programs.

A new confocal microscope system supported by TRIF is enabling a broad spectrum of multidisciplinary studies. Professor Neal Armstrong is performing structural characterization of perovskite photovoltaic materials which are at the forefront of solar energy research and may offer improved efficiencies and reduced costs for renewable energy.

TRIF is critical to extending the capabilities of the Large Binocular Telescope (LBT) to shorter Near InfraRed (NIR) wavelengths, making it the highest resolution imager in the world. Jarron Leisenring PhD, an instrument scientist at the Steward Observatory, says "Using the NIR, Arizona faculty can now submit more compelling science proposals through programs like NASA Origins of Solar Systems and SF

Astronomy and Astrophysics." A team led by Prof. Phil Heinz has used Leisenring's prior cameras to generate LBT's recent unprecedented high-resolution images of active volcanos on Jupiter's moon Io.

In photonics, the Center for Integrated Access Networks (CIAN) Engineering Research Center led by Nasser Peyghambarian has been approved for its seventh year**.** TRIF funding has been leveraged in securing the $27.2M NSF funding received to date, and has positioned the College of Optical Sciences for $15.5M of additional project funding. This is key to enabling high-impact technical contributions that put Arizona on the national stage in the future of internet technology. In addition, in collaboration with principal investigator Mark Neifeld, Professor of Electrical and Computer Engineering and Optical Sciences, Prof. Peyghambarian has secured a $7.5M, five-year Multidisciplinary University Research Initiative from the Dept. of Defense to advance the application of photonics in advanced computing.

Nasser Peyghambarian, Professor of Optical Sciences and Director of CIAN

"TRIF funding has been absolutely instrumental in enabling us to vault Arizona onto the national stage in the field of photonics, including our continued successes in CIAN and a recent $7.5M MURI on optical computing"

TRIF also supported the purchase of a new spatial light modulator which Tom Milster, Professor of Optical Sciences, is incorporating into an Adaptive Optics Teaching Laboratory. This lab program is uniquely established to simultaneously allow on-campus, distance students, as well as off-campus academic, industrial, and national laboratory partners to design, fabricate and test different concepts.

Workforce development is also a key focus of the TRIF Optical Sciences and Technology initiative. A dozen distinct regional outreach events were sponsored with TRIF and TRIF-supported programs, and more comprehensive initiatives include the Research Experience for Undergraduates and Research Experience for Teachers, and Expect Academic Success in STEM, the latter two specifically targeting Native American secondary school faculty and students.

Results – Impact

- $61M in new TRIF-seeded research funding
- Funded 52 graduate student research assistantships and post-docs
- 38 invention disclosures, 13 patents issued, 13 licenses and options
- 64 scientific conference presentations and 215 journal publications.

Tom Milster, Professor of Optical Sciences and Professor of Electrical and Computer Engineering

"TRIF funding has enabled me to develop exceptional laboratory courses that provide our students with remarkable learning opportunities. The new hardware is being integrated into a facility that will allow students on and off campus to design, fabricate and test different concepts with unprecedented degrees of freedom.

WATER, ENVIRONMENTAL AND ENERGY SOLUTIONS

The **Water, Environmental and Energy Solutions (WEES)** 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 to secure adequate supplies of clean water for **Arizona's economic vitality**, **provide a knowledge foundation** to optimize the sustainable use of Arizona's lands, **create an Arizona that is resilient** in the face of climate variability, and support 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 science, technology, and policy efforts
- Focus on use-inspired research performed by multidisciplinary teams that will result in innovative, practical solutions for Arizona and the nation
- Leverage investment in strategic areas to increase public and private sector collaboration and increase the rate of technology transfer and commercial development
- Train a new generation of scientists, engineers, and other professionals for tomorrow's jobs.

UA's initiative in Ecosystem Genomics was jointly awarded $4M NSF funding and has $31M under NSF review after one year in operation.

"Bringing the capabilities of genomic science to the ecosystem science discipline, this initiative works to sequence entire ecosystems, helping people be better prepared to manage disorders of the global environment." – *Scott Saleska, Assoc. Prof., Ecology & Evolutionary Biology.*

Summary of Accomplishments

WEES funds supported a variety of technologies and research to safeguard Arizona's water and energy resources and to develop new economic opportunities. The $10M state-of-the-art Water and Energy Sustainable Technology (WEST) center is developing and demonstrating wastewater treatment and alternative energy technologies that collectively build industry expertise and public trust in recycled water. Elsewhere on campus, researchers are experimenting with innovative methods to recover tellurium from aqueous waste streams. This strategic element is a residue of copper mining and can also be recovered from solar panels for future repurposing in Arizona's manufacturing activities. Other researchers developed a lithium-sulfur battery device that utilizes waste sulfur from petroleum refining to create energy storage technologies. In water policy, UA created a pioneering stakeholder tool to help Arizona's communities balance human and natural area flow needs.

WEES builds cross-sector partnerships for cohesive climate, water, and energy planning in Arizona.
The Water Resources Research Center's 2015 conference, "Indigenous Perspectives on Sustainable Water Practices," which had 350+ in attendance and 70% of the presentations made by tribal members, featured unprecedented dialogue on cultural issues impacting Arizona's waters. The Center for Climate Adaptation Science and Solutions (CCASS) works to increase the economic, human, and infrastructural response capacity of vulnerable communities and industries to the impacts of climate variability. CCASS works closely with Hispanic and Native American leaders to develop adaptation and partnering strategies by coordinating regional meetings. CCASS also supports a project to build resiliency strategies to reduce risk and recognize economic and social opportunities in the electric utility industry, a model that will be extended to other communities and sectors in the future.

Aaron Lien, a Carson Scholar and Ph.D. student in Arid Lands Resource Sciences, is working with southern Arizona ranchers to improve their economic resiliency while helping conserve critical jaguar habitat.

WEES support puts scientific knowledge into action. Arizonans can now monitor drought severity and the U.S. Department of Agriculture can better allocate drought relief via "DroughtView," a UA original web tool. Physicists and atmospheric scientists in the Renewable Energy Network's Renewable Energy Power Forecasting Initiative worked closely with electric utilities to better integrate renewable energy into the grid with advanced and regionally specific forecasting methods. UA won the 2015 New Arizona Prize: Water Consciousness Challenge for its public engagement, "Beyond the Mirage" web tool.

Results – Impact

- $34.6M in new grants, gifts and contracts to the UA from WEES investments in faculty and research
- 279 graduate students, 112 undergraduate students, and 108 post-docs supported through assistantships, wages, scholarships, grants, and research experiences
- 16 new invention disclosures, 20 patent applications filed, 4 patents issued, 2 startup companies, 10 licenses and options
- 69 hosted workshops, conferences, and other events.

UA was among the first universities in the country to answer the National Science Foundation's request to study the nexus of food, energy and water. One hundred researchers, industry leaders, and government officials convened at the Biosphere 2 to identify the top scientific and social questions that address the pressing global need to secure the availability of energy, water and food for future generations.

TECH LAUNCH ARIZONA

Tech Launch Arizona has a key leadership role in the UA's mission to contribute to the economic development of southern Arizona and the nation. **TLA fosters innovation**, expedites technology commercialization and generates new companies suitable for professional investment financing. Through comprehensive services**, TLA builds connections** between the talents of our faculty, researchers and students, the experience of entrepreneurs and investors, and the facilities and programs of Tech Parks Arizona, all **with the goal of creating the optimal commercialization pathway for each invention to maximize its social and economic impact.**

For example, Anivax Inc. is a startup that was launched in FY15 based on UA patented technology developed by UA professors Bibiana Law, Ph.D. and Alexandra Armstrong, Ph.D. with the School of Animal and Comparative Biomedical Sciences. The company is developing a vaccine for Campylobacter, the second most common cause of human foodborne diarrheal illness in the US, causing an estimated 1.3 million human health related cases annually, resulting in $5.6 billion in healthcare costs per year.

Goals

- Engage faculty researchers to encourage participation in the commercialization process and promote a culture of service excellence
- Expedite movement of UA research-derived intellectual property into the commercial sphere and foster the development of these assets along the appropriate commercial trajectories
- Advance the local and global impacts of knowledge creation through community and industry partnerships
- Grow the UA's return on its efforts through an enhanced reputation, a larger economic impact in Arizona, increased industry-sponsored research, and greater licensing revenues

Michael Heien, Ph.D., inventor and Assistant Professor in the Department of Chemistry & Biochemistry, collaborates with a graduate student on developing probes that can be inserted into brain tissue that are resistant to biofouling.

- Expand the Asset Demonstration Program from the former Proof of Concept (POC) Program to $850,000 in FY16 to enable a wider range of asset demonstration activities, including patent claim enhancement and performance and efficacy data.

Summary of Accomplishments

Tech Launch Arizona continues to fulfill a central role in the overall UA mission of creating a positive impact on the Tucson and southern Arizona economies. As of the fiscal year's June 30 close, it has achieved **all** of its performance metrics defined by the Arizona Board of Regents (ABOR). In direct support of the Never Settle strategic plan of the University of Arizona, these metrics not only represent increases over the previous year, but also mark all-time highs.

In 2015, TLA honored UA alumnus Oliver Davis with an I-Squared Award for his work in opening pathways and relationshipos in Tucson and Phoenix for UA-born technologies. Pictured, left to right: UA President Ann Weaver Hart, Oliver Davis, TLA Director of Business Development Resources Sherry Hoskinson, and Tucson lawyer and community leader Larry Hecker.

One key measure of TLA's regional economic influence is the creation of startup companies founded upon university-developed technologies. Over the past five fiscal years, the UA has created **39 new Arizona-based companies** in one of the toughest economic climates in decades. During FY15 alone, TLA was instrumental in helping to create 12 startup companies, compared to 11 in FY14 and three in FY13.

To help successfully launch the highest potential new technologies with the biggest impact, TLA directly funds technology Proof of Concept activities under the POC Program, which will be known going forward as the ***Asset Demonstration Program***. The program provides technical, business and financial support to faculty and researchers to address specific technological and commercial dimensions of promising inventions, enabling movement from concept to consumer. More than $1.7 million has been committed to the program since its initiation in FY13 to promote UA inventions and discoveries, with significant emphasis on awards to faculty and researchers in biosciences, optics, and renewable energy—target industries as defined by the Arizona Commerce Authority (ACA). In FY15, 17 UA inventions were granted POC Program awards, with 11 in the above-mentioned targeted industries.

Results – Impact

- 213 invention disclosures (a 13% increase from FY14)
- 83 licenses and options (a 15% increase from FY14), including 45 exclusive licenses and options
- 200 U.S. patent applications filed and 35 U.S. patents issued (respectively, a 20% and 46% increase, from FY14)
- 12 UA startup companies, 10 of which are in Arizona (a 9% increase from FY14)
- $2.4M in revenue from royalties and patent reimbursements for intellectual property, a 45% increase from FY14, plus a one-time settlement payment of $2.3M.

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BOARD OF Regents

ARIZONA'S PUBLIC UNIVERSITIES

EDUCATE · DISCOVER · IMPACT

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ABOR TRIF FUNDS

TRIF funds allocated to the board office are used to support positions and projects that advance Arizona's public universities in accordance with the Arizona law, Board guidelines and strategic plan. Each of these projects is intended to further the goals outlined in Arizona public universities' strategic plan and strengthen the Board's ability to provide oversight of the universities' research and Arizona's workforce development activities.

The ABOR office directs the expenditure of funds to several small, statewide projects. In FY 2015, TRIF continued to fund the National Student Clearinghouse (part of a multi-year commitment), ABOR-IT projects, and the Sci-Tech Festival. 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 Arizona's high school graduates as relevant to the state's workforce and economic development objectives.

ABOR RESEARCH INFORMATION TECHNOLOGY

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

SCI-TECH FESTIVAL

The Arizona SciTech Festival is a statewide 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.

NEW ABOR-TRIF SPONSORED PROJECTS

This year ABOR sponsored several new projects and activities: The Education Advisory Board, a joint technology transfer position with the Arizona Commerce Authority (ACA), K-12 pipeline collaborations, production of reports, collaboration with the mining industry, and the Bio-Accel Scorpion Pit event.

- The Education Advisory Board (EAB) research assists the ABOR office in uncovering and sharing the best information and ideas from across higher education. Through EAB membership, the ABOR office canvases thousands of colleges and universities to understand higher education's biggest problems and collaborate on breakthrough, peer-tested solutions. The concept is to provide tools to help Arizona's public universities achieve maximum efficiency. Across the country, public university systems are fulfilling their roles as laboratories of innovation and there are many lessons and practices that system offices share with one another through their EAB membership. For example, EAB recently performed a study for Arizona's public universities on how educational quality is measured in other public university systems. This study is being used as the foundation for the board's discussion and actions around providing oversight of educational quality within Arizona's public universities.
- Together with the ACA, ABOR is supporting a technology transfer/research enterprise specialist who works with both entities to highlight and coordinate the universities' technology transfer and commercialization work. This position also focuses on connecting industry needs to university contacts.
- TRIF funding supports work on the High School Eligibility Study compiled by ABOR. The report, reflecting K-12 student preparedness to enter post-secondary education, will be available on the ABOR website when complete.
- A video highlighting technology transfer at the universities was created and shared at the March 31st Arizona Bioscience Roadmap event. https://www.youtube.com/watch?v=QiJzFxSD4ak
- In February, ABOR hosted a roundtable with executives from Arizona's mining industry. The university presidents and the vice presidents of research joined the conversation for an afternoon designed to identify industry needs and the universities' ability to meet their educational needs. Based on industry requests, follow-up opportunities are being developed.

SOLUTIONS CHALLENGE, SCORPION PIT

The Solutions Challenge is an annual competition designed to better align market need, with innovation and early investment to stimulate company formation in novel medical technology. The program researches areas of critical healthcare and market need, then challenges entrepreneurs to create innovative solutions to address them. Selected finalists must convince the "Scorpion Pit" investors to provide private funding that Bio-Accel will match in financial support. This competition hosts Arizona's premier network of early stage healthcare investors as its Scorpion Pit judges.

bioaccel solutions challenge

REGENTS' INNOVATION FUND

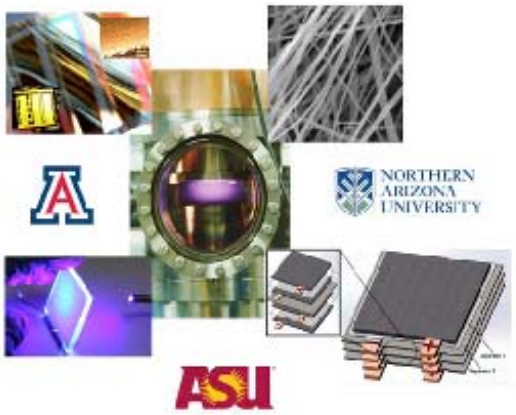
The Regents' Innovation Fund (RIF) continues to be instrumental in supporting the research activities of the universities, and in contributing toward the collaborative efforts among the universities and with community partners.

As part of the September 2014 Board meeting, the Regents approved funding two additional RIF projects. These projects were designed and submitted by a tri-university collaborative effort. The Digital Research Infrastructure: Live Data project (originally funded in Sept 2012) was approved for additional funding. A new project, At the Interface: Hybrid Materials, received the remaining available funds.

AT THE INTERFACE: HYBRID MATERIALS LEADING TO NEW ENERGY CONVERSION AND ENERGY STORAGE PLATFORMS

This project establishes a tri-university center of expertise enabling a broad science-based approach to the incorporation of a focused set of new hybrid materials into energy conversion, energy storage and solar-assisted water purification technologies that will combine ASU/NAU/UA researchers with complementary expertise. Three interdisciplinary projects have been proposed; each builds upon recent discoveries that are designed to evolve as components of new extramurally funded efforts:

- Integration of new active layers and new ALD oxide interlayers for efficient charge collection, and optimized energy conversion efficiencies in solar-electric platforms;
- Integration of new solar-electric energy conversion technologies into unique solar glass platforms with tailored interfaces;
- Integration of new materials and ALD oxide thin films in substantially fabricated load carrying super capacitors (LCS) as energy storage platforms.



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

The LiveData taskforce launched the Research Arizona web portal (researchaz.org) in December 2014. The portal is a discovery layer that combines the research and scholarly outputs of all three universities. At present, the site has over 50,000 records.

The primary undertaking of the taskforce in 2015 has been the purchase of Rosetta. Rosetta is a commercial grade digital preservation product capable of supporting the ingestion of large numbers of digital objects through various mechanisms, including batch loads, staging areas and multiple deposit hierarchies. This product has the flexibility to allow us to configure it specifically to meet data storage and sharing needs of all three universities, including the development of specific workflows to support our individual institutional needs.

ExLibris Rosetta

A Rosetta implementation capable of supporting all three universities will require customization to accommodate each anticipated workflow. The initial implementation of Rosetta will include significant implementation support from the supplier. The supplier will also train multiple personnel to provide technical support as the product goes into production. Pilot activities are anticipated to ensure that production installations are implemented smoothly. Implementation is scheduled to begin in the fall of 2015.

ARIZONA ENVIRONMENTAL GRID INFRASTRUCTURE SERVICE (AEGIS)

Arizona Environmental Grid Infrastructure Service

The Regents Innovation Project, AEGIS (Arizona Environmental Grid Infrastructure Service), fosters growth within the scientific community by utilizing world-class computing resources for training the next generation of scientists. The AEGIS platform provides the collaborative computational infrastructure and training for researchers and educators for developing large-scale analytics platforms for biological and environmental systems that elevates research at Arizona universities into a national leadership position in the emerging area of environmental informatics. AEGIS has fully deployed a dedicated cyberinfrastructure that includes federated storage resources across the three universities. AEGIS resources are able to fully utilize the advanced networking capabilities provided through the AZ Sun Corridor network connecting the three universities. The AEGIS team has hosted a series of Software Carpentry and Spatial Data Carpentry boot camps with over 120 individuals participating to date. AEGIS has successfully demonstrated integration with NASA next generation climate analytics systems as part of the boot camps.

All of these projects enable Arizona's universities to be more competitive competing for research grants. The projects also encourage university collaboration.

System Summary

TRIF Metrics and Financials

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

	FY 2012 ACTUAL	*FY 2013 ACTUAL*	*FY 2014 ACTUAL*	*FY 2015 ACTUAL*	*FY 2015 BUDGET*	*FY 2016 BUDGET*
REVENUE						
Carryforward	$ 3,142,709	$ 7,151,749	$ 7,688,082	$ 7,531,736	$ 7,066,545	$ 11,718,613 *
TRIF Revenue	57,256,220	58,464,496	66,720,070	68,438,425	62,385,000	63,512,184
TOTAL REVENUE	**$ 60,398,929**	**$ 65,616,245**	**$ 74,408,152**	**$ 75,970,161**	**$ 69,451,545**	**$ 75,230,797**
EXPENDITURES						
OPERATING						
Personal Services	$ 19,115,118	$ 20,768,253	$ 23,679,972	$ 23,456,465	$ 22,283,225	$ 24,228,621
ERE	6,422,325	7,104,053	7,908,115	7,978,672	7,588,142	8,378,042
All Other Operating	14,649,793	19,066,524	18,661,268	17,242,841	19,390,986	21,588,099
Grants/Projects	659,993	1,923,049	3,178,080	1,356,294	4,217,092	4,612,315
TOTAL OPERATING	**40,847,228**	**48,861,879**	**53,427,435**	**50,034,272**	**53,479,445**	**58,807,076**
CAPITAL						
Building Renovation	400,126	140,000	1,416,656	290,683	1,640,000	1,430,367
Debt Service	6,430,990	6,206,984	8,288,221	9,240,960	9,626,500	10,043,863
ASU Polytechnic/West COPs	3,716,100	3,719,300	3,709,400	3,704,000	3,704,000	3,707,500
AZUN	500,000	500,000	500,000	500,000	500,000	500,000
Equipment Acquisition	962,046	-	-	481,633	501,600	741,991
TOTAL CAPITAL	**12,009,262**	**10,566,284**	**13,914,277**	**14,217,276**	**15,972,100**	**16,423,721**
EXPENDITURES TOTAL	**$ 52,856,490**	**$ 59,428,163**	**$ 67,341,712**	**$ 64,251,548**	**$ 69,451,545**	**$ 75,230,797**
SUMMARY BY PROGRAM AREA						
Access/Workforce Development	6,602,968	6,397,615	6,989,710	6,719,434	6,929,701	8,018,901
Improving Health	24,670,151	27,202,002	32,855,199	31,257,013	31,564,772	31,763,572
National Security Systems Initiative	1,628,600	2,126,300	1,983,800	2,059,800	3,036,800	5,661,000
Space Exploration and Optical Solutions	4,059,940	4,381,674	4,051,062	4,389,409	4,691,830	5,027,975
Water, Environment and Energy Solutions	8,996,196	10,302,034	11,035,632	10,025,800	11,613,030	12,670,345
UARC: Tech Launch Arizona	1,334,442	1,999,593	2,262,558	2,330,330	2,343,280	2,419,189
Regents Innovation Fund	778,359	2,098,342	3,351,273	1,616,961	4,467,092	4,862,315
ASU Polytechnic COPS	2,082,600	2,082,100	2,077,300	2,076,400	2,076,400	2,077,700
ASU West COPS	1,633,500	1,637,100	1,632,100	1,627,600	1,627,600	1,629,800
AZUN	1,069,734	1,201,403	1,103,078	2,148,801	1,101,040	1,100,000
PROGRAM AREA TOTAL	**52,856,490**	**59,428,163**	**67,341,712**	**64,251,548**	**69,451,545**	**75,230,797**
EXPENDITURES TOTAL	**$ 52,856,490**	**$ 59,428,163**	**$ 67,341,712**	**$ 64,251,548**	**$ 69,451,545**	**$ 75,230,797**

*ABOR received $6,053,497 in excess of the TRIF revenue anticipated budgets.
These funds were distributed to the three universities in August and are reflected as "carry forward" in their financials

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ASU
ARIZONA STATE
UNIVERSITY

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ARIZONA STATE UNIVERSITY

TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)

FY 2012 - 2016

	FY 2012 ACTUAL	*FY 2013 ACTUAL*	*FY 2014 ACTUAL*	*FY 2015 ACTUAL*	*FY 2015 BUDGET*	*FY 2016 BUDGET*
REVENUE						
Carryforward	$ 790,200	$ 1,788,900	$ 2,349,600	$ 2,132,500	$ 2,132,500	$ 2,919,627
TRIF Revenue	23,848,700	25,091,200	26,944,700	28,357,727	25,936,400	26,384,500
TOTAL REVENUE	**$ 24,638,900**	**$ 26,880,100**	**$ 29,294,300**	**$ 30,490,227**	**$ 28,068,900**	**$ 29,304,127**
EXPENDITURES						
OPERATING						
Personal Services	$ 7,684,500	$ 7,722,700	$ 8,446,600	$ 8,953,600	$ 7,960,500	$ 8,799,028
ERE	2,883,800	2,782,000	2,950,800	3,096,700	2,781,000	3,043,240
All Other Operating	6,479,000	7,362,900	8,676,200	8,119,200	8,176,900	8,218,960
TOTAL OPERATING	**17,047,300**	**17,867,600**	**20,073,600**	**20,169,500**	**18,918,400**	**20,061,227**
CAPITAL						
Building Renovation	-	-	25,500	-	1,000,000	1,000,000
Debt Service	2,086,600	2,943,600	3,353,300	3,697,100	4,446,500	4,535,400
ASU Poly/ASU West COPs	3,716,100	3,719,300	3,709,400	3,704,000	3,704,000	3,707,500
TOTAL CAPITAL	**5,802,700**	**6,662,900**	**7,088,200**	**7,401,100**	**9,150,500**	**9,242,900**
TOTAL EXPENDITURES	**$ 22,850,000**	**$ 24,530,500**	**$ 27,161,800**	**$ 27,570,600**	**$ 28,068,900**	**$ 29,304,127**
SUMMARY BY INITIATIVE						
National Security Systems Initiative	$ 1,628,600	$ 2,126,300	$ 1,983,800	$ 2,059,800	$ 3,036,800	$ 5,661,000
Improving Health	13,974,400	14,877,300	17,931,000	17,390,200	16,916,500	14,996,927
Water, Environment and Energy Solutions	3,530,900	3,807,700	3,537,600	4,416,600	4,411,600	4,938,700
ASU Polytechnic COPS	2,082,600	2,082,100	2,077,300	2,076,400	2,076,400	2,077,700
ASU West COPS	1,633,500	1,637,100	1,632,100	1,627,600	1,627,600	1,629,800
TOTAL EXPENDITURES	**$ 22,850,000**	**$ 24,530,500**	**$ 27,161,800**	**$ 27,570,600**	**$ 28,068,900**	**$ 29,304,127**

ARIZONA STATE UNIVERSITY

IMPROVING HEALTH FOCUS AREA

PERFORMANCE ANALYSIS	Actual FY 12	Actual FY 13	Actual FY 14	Actual FY 15	Projected FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	$ 13,974,400	$ 14,877,300	$ 17,931,000	$ 17,390,200	$ 16,916,500	$ 14,996,927
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	$ 54,537,411	$ 61,184,668	$ 67,217,416	$ 60,740,785	$ 85,000,000	$ 98,000,000
Gifts & Other Sources	40,505	390,000	2,245,202	1,778,849	40,000	40,000
Royalty Income	821,889	156,201	1,068,587	555,715	800,000	800,000
TOTAL	**55,399,805**	**61,730,869**	**70,531,205**	**63,075,349**	**85,840,000**	**98,840,000**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	45	70	41	56	85	95
US Patents Issued	0	5	13	6	6	6
Licenses and Options Executed	13	29	26	21	17	18
Startup Companies	2	1	1	4	1	1
WORKFORCE CONTRIBUTION						
Academic and Postdoctoral Appointees	38	155	119	116	135	175
Graduate Students	111	87	80	103	110	110
Undergraduate Students	73	90	70	52	70	70

ARIZONA STATE UNIVERSITY

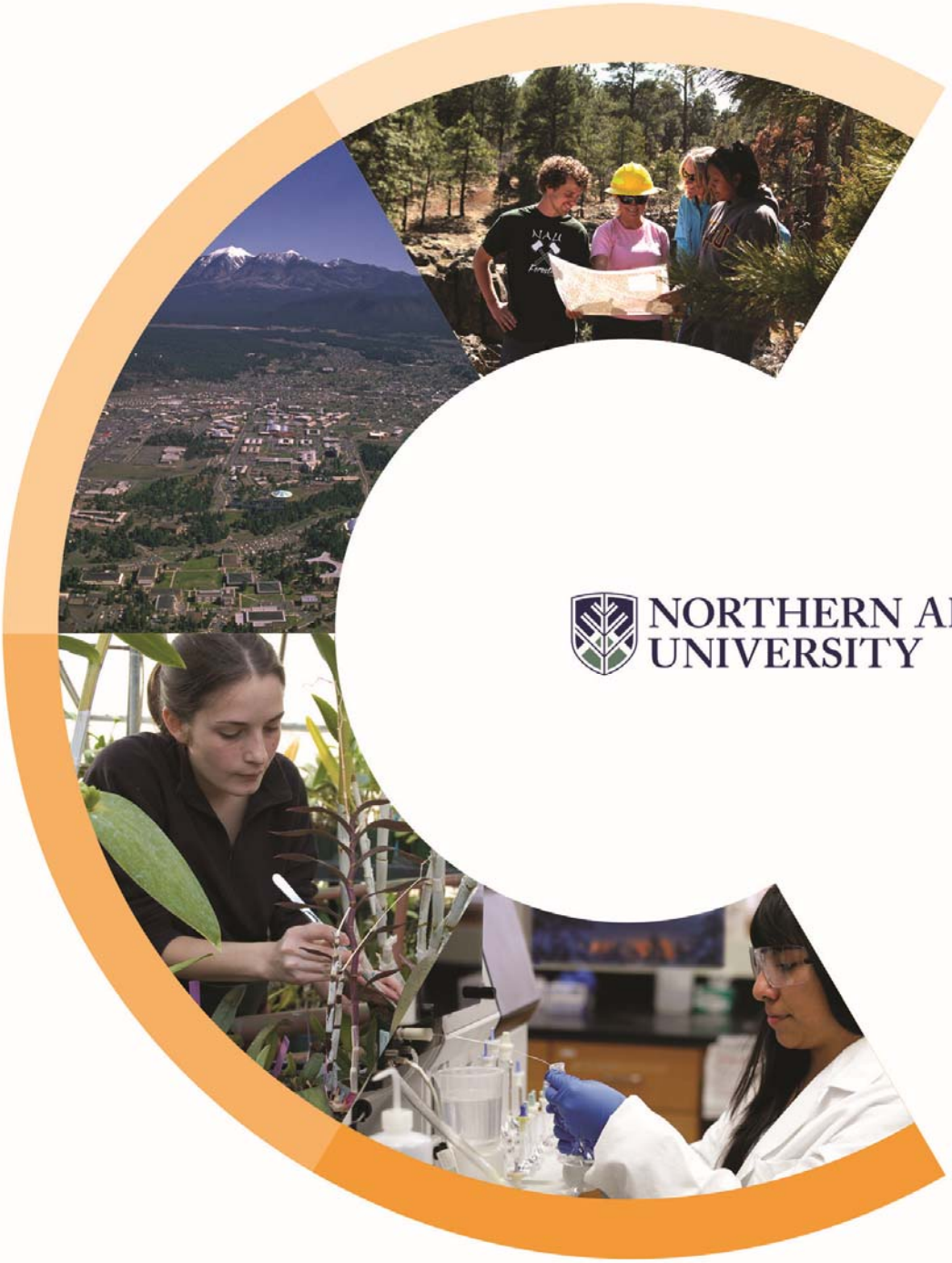
NATIONAL SECURITY SYSTEMS FOCUS AREA

PERFORMANCE ANALYSIS	Actual FY 12	Actual FY 13	Actual FY 14	Actual FY 15	Projected FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	$ 1,628,600	$ 2,126,300	$ 1,983,800	$ 2,059,800	$ 3,036,800	$ 5,661,000
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	$ 12,618,000	$ 23,010,570	$ 34,269,118	$ 34,308,540	$ 45,000,000	$ 70,000,000
Gifts & Other Sources	-	-	-	-	10,000	10,000
Royalty Income	128,250	82,500	1,265,956	30,000	555,000	725,000
TOTAL	**12,746,250**	**23,093,070**	**35,535,074**	**34,338,540**	**45,565,000**	**70,735,000**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	9	7	32	25	25	30
US Patents Issued	0	3	13	7	1	2
Licenses and Options Executed	2	3	28	4	3	4
Startup Companies	0	0	0	0	0	0
WORKFORCE CONTRIBUTION						
Academic and Postdoctoral Appointees	0	6	15	35	23	25
Graduate Students	17	40	23	26	20	20
Undergraduate Students	0	8	8	15	5	5

ARIZONA STATE UNIVERSITY

WATER, ENVIRONMENTAL AND ENERGY SOLUTIONS FOCUS AREA

PERFORMANCE ANALYSIS	Actual FY 12	Actual FY 13	Actual FY 14	Actual FY 15	Projected FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	$ 3,530,900	$ 3,807,700	$ 3,537,600	$ 4,416,600	$ 4,411,600	$ 4,938,700
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	$ 12,122,712	$ 12,392,507	$ 14,598,426	$22,030,094	$ 17,000,000	$ 17,000,000
Gifts & Other Sources	-	-	-	8,446,221	25,000	25,000
Royalty Income	252,018	184,720	55,018	152,798	475,000	610,000
TOTAL	**12,374,730**	**12,577,227**	**14,653,444**	**$30,629,113**	**17,500,000**	**17,635,000**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	0	1	8	28	11	12
US Patents Issued	1	4	2	3	4	4
Licenses and Options Executed	3	1	8	5	12	12
Startup Companies	0	0	0	0	0	1
WORKFORCE CONTRIBUTION						
Academic and Postdoctoral Appointees	7	17	11	33	20	20
Graduate Students	36	77	49	102	35	35
Undergraduate Students	13	78	23	153	15	15



NORTHERN ARIZONA UNIVERSITY

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

	FY 2012 *ACTUAL*	*FY 2013* *ACTUAL*	*FY 2014* *ACTUAL (REVISED)*	*FY2015* *ACTUAL*	*FY 2015* *BUDGET*	*FY 2016* *BUDGET*
REVENUE						
Carryforward	$ 1,630,638	$ 1,821,191	$ 1,566,408	$ 866,212	$ 401,021	$ 1,951,075
TRIF Revenue	11,157,019	11,492,061	13,163,391	13,426,899	12,216,200	12,438,500
TOTAL REVENUE	**$ 12,787,657**	**$ 13,313,252**	**$ 14,729,799**	**$ 14,293,111**	**$ 12,617,221**	**$ 14,389,575**
EXPENDITURES						
OPERATING						
Personal Services	$ 4,630,588	$ 5,337,771	$ 6,113,394	$ 5,945,506	$ 5,461,335	$ 5,999,308
ERE	1,497,041	1,684,731	1,946,342	2,008,168	1,843,848	2,063,984
All Other Operating	1,641,711	3,960,958	3,477,778	2,407,583	2,990,438	3,945,463
TOTAL OPERATING	**7,769,340**	**10,983,460**	**11,537,514**	**10,361,257**	**10,295,621**	**12,008,755**
CAPITAL						
Building Renovation			1,391,156	290,683	640,000	430,367
Debt Service	1,344,390	263,384	434,917	708,463	680,000	708,463
Equipment Acquisition	962,046			481,633	501,600	741,991
AZUN	500,000	500,000	500,000	500,000	500,000	500,000
TOTAL CAPITAL	**2,806,436**	**763,384**	**2,326,073**	**1,980,779**	**2,321,600**	**2,380,821**
TOTAL EXPENDITURES	**$ 10,575,776**	**$ 11,746,844**	**$ 13,863,587**	**$ 12,342,036**	**$ 12,617,221**	**$ 14,389,576**
SUMMARY BY INITIATIVE						
Access/Workforce Development	$ 6,602,968	$ 6,397,615	$ 6,989,710	$ 6,719,434	$ 6,929,701	$ 8,018,901
AZUN	1,069,734	1,201,403	1,103,078	2,148,801	1,101,040	1,100,000
Improving Health	1,253,436	2,130,689	2,281,436	2,372,761	2,293,240	2,635,337
Water, Energy, Environmental Solutions	1,649,638	2,017,137	3,489,363	1,101,040	2,293,240	2,635,337
TOTAL EXPENDITURES	**$ 10,575,776**	**$ 11,746,844**	**$ 13,863,587**	**$ 12,342,036**	**$ 12,617,221**	**$ 14,389,575**

NORTHERN ARIZONA UNIVERSITY
WEES and IMPROVING HEALTH

PERFORMANCE ANALYSIS	Actual FY 12	Actual FY 13	Actual FY 14	Projected FY 15	Actual FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	10,775,776	11,746,844	13,863,587	12,617,221	12,342,216	12,438,500
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	14,105,945	11,848,074	17,711,283	15,867,270	20,395,581	16,501,960
Gifts & Other Sources	1,500,000	0	0	50,000	1,000,000	50,000
Intellectual Property Income	22,276	29,299	32,075	22,000	74,907	23,100
TOTAL	**15,628,221**	**11,877,373**	**17,743,358**	**15,939,270**	**21,470,488**	**16,575,060**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	17	18	24	24	27	25
US Patents Issued	1	2	3	3	2	3
Licenses and Options Executed	1	0	1	4	1	5
Startup Companies	1	0	1	2	1	1
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	11	17	22	15	11	18
Graduate Students	92	44	187	125	99	130
Undergraduate Students	200	251	233	250	360	250

ACCESS/WORKFORCE DEVELOPMENT/E-LEARNING

PERFORMANCE MEASURE	FY 12 Actuals	FY13 Actuals	FY14 Actuals	FY15 Actuals	FY 15 Projected	FY 16 Projected
RETURN ON INVESTMENT (ROI)						
Annual impact of Graduates on Economy[1]	$10.4M	$11.3 M	$12.4 M	$13.5 M	$13.5 M	$14.7 M
TECHNOLOGY TRANSFER/CURRICULUM INNOVATIONS						
Web/Hybrid/Enhanced Courses Developed [2]	141	506[2a]	612	650	180	200
Faculty Developing Courses[3]	265	420	485	331	300	350
Increase in Student Technology Literacy[4]	4,122	2,676	7,108	7,810	4,000	4,200
Degree/Certificate Programs Offered[5]	49	48	46	49	49	52
INDUSTRY OUTREACH						
Business/Nonprofit Collaborations[6,A]	203	263	298	261	140	155
WORKFORCE CONTRIBUTIONS						
Number of Student Served by A/WD[7]	3,772	3,616	3,695	3,433	4,013	4,374
PARTNERSHIPS/COLLABORATIONS						
Community College/NAU Students[8]	3,077	3,444	4,573	6,336	4,751	5,179
Community College to NAU Programs[9,B]	71	79	85	94	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 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

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THE UNIVERSITY OF ARIZONA

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

	FY 2012 ACTUAL	*FY 2013 ACTUAL*	*FY 2014 ACTUAL*	*FY2015 ACTUAL*	*FY 2015 BUDGET*	*FY 2016 BUDGET*
REVENUE						
Carryforward		$ 1,476,104	$ 1,795,547	$ 2,065,932	$ 2,065,932	$ 3,997,780
TRIF Revenue	20,128,459	21,371,920	23,235,333	24,653,799	22,232,400	22,677,000
TOTAL REVENUE	**$ 20,128,459**	**$ 22,848,024**	**$ 25,030,880**	**$ 26,719,731**	**$ 24,298,332**	**$ 26,674,780**
EXPENDITURES						
OPERATING						
Personal Services	$ 6,711,059	$ 7,576,482	$ 8,990,322	$ 8,357,929	$ 8,730,090	$ 9,298,985
ERE	2,013,928	2,600,007	2,974,069	2,817,961	2,923,894	3,231,418
All Other Operating	6,527,242	7,735,989	6,500,657	6,710,664	8,144,348	9,344,377
TOTAL OPERATING	**15,252,229**	**17,912,478**	**18,465,048**	**17,886,554**	**19,798,332**	**21,874,780**
CAPITAL						
Building Renovation	400,126	140,000	-	-	-	-
Debt Service	3,000,000	3,000,000	4,500,004	4,835,397	4,500,000	4,800,000
TOTAL CAPITAL	**3,400,126**	**3,140,000**	**4,500,004**	**4,835,397**	**4,500,000**	**4,800,000**
TOTAL EXPENDITURES	**$ 18,652,355**	**$ 21,052,478**	**$ 22,965,052**	**$ 22,721,951**	**$ 24,298,332**	**$ 26,674,780**
SUMMARY BY INITIATIVE						
Improving Health	$ 9,442,315	$ 10,194,012	$ 12,642,763	$ 11,494,052	$ 12,355,032	$ 14,131,308
Space & Optical Sciences	4,059,940	4,381,674	4,051,062	4,389,409	4,691,830	5,027,975
Water, Environmental, Energy Solutions	3,815,658	4,477,197	4,008,669	4,508,160	4,908,190	5,096,308
Tech Launch Arizona (UARC)	1,334,442	1,999,593	2,262,558	2,330,330	2,343,280	2,419,189
TOTAL EXPENDITURES	**$ 18,652,355**	**$ 21,052,476**	**$ 22,965,052**	**$ 22,721,951**	**$ 24,298,332**	**$ 26,674,780**

UNIVERSITY OF ARIZONA

TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)

IMPROVING HEALTH

PERFORMANCE ANALYSIS	Actual FY 12	Actual FY 13	Actual FY14	Actual FY 15	Projected FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	$ 9,442,315	$ 10,194,012	$ 12,642,763	$ 11,494,052	$ 12,355,032	$ 14,131,308
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	57,727,313	39,332,176	50,077,598	64,444,304	54,000,000	54,000,000
Gifts & Other Sources	581,469	594,746	300,040	612,415	500,000	500,000
Royalty Income	122,429	12,500	28,500	64,029	-	-
TOTAL	**$ 58,431,211**	**$ 39,939,422**	**$ 50,406,138**	**$ 65,120,748**	**$ 54,500,000**	**$ 54,500,000**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	15	10	28	37	32	32
US Patents Issued	2	3	2	5	0	1
Licenses and Options Executed	4	0	8	8	9	10
Startup Companies	0	0	1	2	1	0
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	80	86	96	178	135	135
Graduate Students	179	189	244	376	320	320
Undergraduate Students	209	324	325	424	320	320

UNIVERSITY OF ARIZONA

TECHNOLOGY AND RESEARCH INITIATIVE FUND (TRIF)
SPACE EXPLORATION AND OPTICAL SOUTIONS

PERFORMANCE ANALYSIS	Actual FY 12	Actual FY 13	Actual FY 14	Actual FY15	Projected FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	$ 4,059,940	$ 4,381,674	$ 4,051,062	$ 4,389,409	$ 4,691,830	$ 5,027,975
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	49,376,201	54,965,135	45,218,973	61,081,430	57,000,000	65,000,000
Gifts & Other Sources	237,436	428,842	359,749	390,526	490,000	510,000
Royalty Income	187,572	150,777	97,056	113,208	200,000	200,000
TOTAL	**$ 49,801,209**	**$ 55,544,754**	**$ 45,675,778**	**$ 61,585,164**	**$ 57,690,000**	**$ 65,710,000**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	48	37	19	38	55	60
US Patents Issued	14	9	4	13	18	20
Licenses and Options Executed	14	6	8	13	19	21
Startup Companies	2	1	1	0	3	3
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	10	10	11	12	12	12
Graduate Students	34	50	45	40	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	Actual FY 15	Projected FY 15	Projected FY 16
TRIF EXPENDITURES						
Total	$ 3,815,658	$ 4,477,197	$ 4,008,669	$ 4,508,160	$ 4,908,190	$ 5,096,308
FINANCIAL IMPACT OF TRIF INVESTMENT						
Sponsored Awards	26,366,576	30,024,250	46,878,228	30,560,426	22,500,000	23,100,000
Gifts & Other Sources	3,433,880	3,676,766	3,267,587	4,013,983	3,600,000	3,800,000
Royalty Income	0	0	15,000	74,186	300,000	500,000
TOTAL	**$ 29,800,456**	**$ 33,701,016**	**$ 50,160,815**	**$ 34,648,595**	**$ 26,400,000**	**$ 27,400,000**
TECHNOLOGY TRANSFER ACTIVITY						
Invention Disclosures Transacted	19	21	26	16	10	10
US Patents Issued	2	2	1	4	2	3
Licenses and Options Executed	1	1	4	10	7	7
Startup Companies	1	1	1	2	1	1
WORKFORCE CONTRIBUTION						
Postdoctoral Appointees	87	49	41	108	80	85
Graduate Students	321	314	255	279	260	270
Undergraduate Students	122	85	99	112	110	120

BOARD OF Regents

ARIZONA'S PUBLIC UNIVERSITIES

EDUCATE · DISCOVER · IMPACT

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

	FY 2012 ACTUAL	*FY 2013 ACTUAL*	*FY 2014 ACTUAL*	*FY 2015 ACTUAL*	*FY 2015 BUDGET*	*FY 2016 BUDGET*
REVENUE						
Carryforward	$ 721,871	$ 2,065,554	$ 1,976,527	$ 2,467,092	$ 2,467,092	$ 2,837,947
TRIF Revenue	2,122,042	509,315	3,841,837	2,000,000	2,000,000	2,012,184
TOTAL REVENUE	**$ 2,843,913**	**$ 2,574,869**	**$ 5,818,364**	**$ 4,467,092**	**$ 4,467,092**	**$ 4,850,131**
EXPENDITURES						
OPERATING						
Personal Services	$ 88,971	$ 131,300	$ 129,656	$ 199,430	$ 131,300	$ 131,300
ERE	27,555	37,315	36,904	55,843	39,400	39,400
All Other Operating	1,840	6,678	6,633	5,394	79,300	79,300
TOTAL OPERATING	**118,366**	**175,293**	**173,193**	**260,667**	**250,000**	**250,000**
GRANTS/PROJECTS						
Pass Through to Universities			1,750,000			
Regents Innovation Fund	659,993	1,923,049	1,428,080	1,000,000	1,941,824	1,941,824
Other				356,294	2,275,268	2,658,307
TOTAL GRANTS/PROJECTS	**659,993**	**1,923,049**	**3,178,080**	**1,356,294**	**4,217,092**	**4,600,131**
TOTAL EXPENDITURES	**$ 778,359**	**$ 2,098,342**	**$ 3,351,273**	**$ 1,616,961**	**$ 4,467,092**	**$ 4,850,131**
SUMMARY BY INITIATIVE						
Pass Through to Universities			1,750,000			
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	100,000
Collaboration				17,669	510,707	693,038
SciVal		202,000		50,000		
Graduate Research Grants		230,000				
IT Research (ABOR)		16,180	54,980	28,840	28,840	
Regent Innovation Fund Grants		1,100,000	1,231,950	1,000,000	1,941,824	1,941,824
Other	60,691		92,723	259,785	1,685,721	1,865,269
TOTAL EXPENDITURES	**$ 659,993**	**$ 1,923,049**	**$ 3,178,080**	**$ 1,356,294**	**$ 4,217,092**	**$ 4,600,131**

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