

# TECHNOLOGY AND RESEARCH INITIATIVE FUND

ARIZONA STATE UNIVERSITY

FISCAL YEAR 2022





# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Access and Workforce Development			
Program Name:	Corporate Engagement and Strategic Partnerships			
<b>Problem Statement:</b> ASU is an institution that prioritizes use-inspired research, student experiential learning, student success and community embeddedness. This requires a deep understanding of the needs of the external community and the agility, commitment and will to mobilize university resources to match and problem-solve in real time. ASU's Corporate Engagement and Strategic Partnerships team builds long-term, mutually beneficial partnerships that help Arizona's constituents and the entire U.S. economic ecosystem.				
<b>Program Description:</b> Corporate Engagement and Strategic Partnerships advances university-wide research and education efforts in key sectors such as semiconductors, sustainability, health futures and workforce development. The program facilitates complex engagements to leverage the abilities of the community, the university and our business collaborators while supporting all stakeholders. Our work is individualized, transformative and impactful to best support all involved, especially Arizona. By expanding and diversifying the workforce, developing novel solutions to complex challenges, and finding innovative approaches to advancing research and development initiatives, Corporate Engagement and Strategic Partnerships infuses ASU's productivity and innovation into the economy through intentional engagement and partnership.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> ASU's advantage is the university's vast resources and networks across Arizona. Through one-of-a-kind academic-corporate partnerships, corporate collaborators can access ASU's world-class faculty and student talent, cutting-edge research and development, and state-of-the-art facilities. Corporate Engagement and Strategic Partnerships provides partners with an institutional commitment to collaboration, growth and impact on a global scale, coupled with a response time that is required for industry engagement. Anticipated funding opportunities are broad given the different assets and clients we serve. Funding will come in the form of direct industry-sponsored research projects, consortium fees, corporate philanthropy, leases paid in Innovation Zones at ASU, fees for custom academic or non-credit programs and/or federally sponsored research, with corporate partners as supporters or subcontractors.				
<b>Is there an Arizona Specific Benefit or Impact?</b> There are significant impacts and benefits to Arizona. The work performed by the Corporate Engagement and Strategic Partnerships team supports economic and community development groups to recruit companies to relocate or expand their business in Arizona. Recent examples include the \$20 billion Intel expansion, \$8 million investment by Applied Materials and the \$32 billion TSMC location to Arizona, creating over 3,000 jobs in the state. We will also create opportunities to increase technological access throughout the state through public-private partnerships with industry giants such as Dell and Verizon, organizations that have prioritized closing the digital divide and providing access to remote and rural areas.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	500,000	500,000	500,000	1,500,000
Development	500,000	500,000	500,000	1,500,000
Total	1,000,000	1,000,000	1,000,000	3,000,000
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	1	1	1	3
Graduate Students	5	6	8	19
Undergraduate Students	2	2	2	6
Sponsored Project Funding	107,000	112,000	118,000	337,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Access and Workforce Development			
Program Name:	Corporate Engagement and Strategic Partnerships			
2022 Progress Summary:				
<p>Corporate Engagement and Strategic Partnerships facilitates complex and customized engagements to leverage the abilities of the Arizona community, the university and our business collaborators for the benefit of all stakeholders. Our efforts bring jobs to Arizona, boost the economy and advance local industries for the benefit of all residents of the state.</p> <ul style="list-style-type: none"> <li>• Our teams were instrumental in KORE Power selecting Arizona for its one million square foot lithium-ion battery manufacturing facility, bringing 3,000 jobs to Arizona; LG Energy Solution's \$1.4 billion investment in a state-of-the-art battery manufacturing facility; and Blue Origin's Phoenix location, bringing in jobs focused on avionics, systems engineering and integrated supply chain.</li> <li>• We secured numerous corporate, community and government partners for the \$16.5 million Arizona State University and AZNext EDA Good Jobs Challenge proposal to address acute talent shortages in the health care and information technology workforce.</li> <li>• In partnership with the Greater Phoenix Economic Council, we submitted a \$20 million proposal to the Build Back Better Regional Challenge to create a Health Futures Manufacturing Innovation Center adjacent to Mayo Clinic in North Phoenix, with support from the Arizona Commerce Authority, City of Phoenix and Mayo Clinic.</li> <li>• ASU contributed to Mayo Clinic's decision to purchase 228 acres of land in Phoenix, known as Discovery Oasis. ASU is considered the first anchor tenant of the space.</li> <li>• Over 25 companies, such as Komatsu and Raven Industries, have located at ASU Innovation Zones. One of these zones, the Novus Innovation Corridor, has had a \$1.86 billion impact to date.</li> <li>• We have brought in over \$3.2 million in awards with industry giants such as Zoom, Taiwan Semiconductor Manufacturing Company, Procter and Gamble, and Blue Cross Blue Shield.</li> <li>• Corporate Engagement and Strategic Partnerships supported the promotion and business development for the two Science and Technology Centers developed under the New Economy Initiative and launched in FY 2022, as well as ASU Learning Enterprise upskilling and reskilling programs.</li> </ul>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	541,262			541,262
Development	541,262			541,262
Total	1,082,524	0	0	1,082,524
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	1			1
Graduate Students	7			7
Undergraduate Students	43			43
Sponsored Project Funding	174,994			174,994
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Access and Workforce Development			
Program Name:	J. Orin Edson Entrepreneurship + Innovation Institute			
<b>Problem Statement:</b> Funding is needed to stimulate new collaborations with academic units, provide entrepreneurial training and development opportunities, and to supply the related material resources needed to continue to strengthen Arizona's entrepreneurial community and ecosystem.				
<b>Program Description:</b> The J. Orin Edson Entrepreneurship + Innovation Institute (Edson E+I) stimulates new collaborations with academic units to add dimension to both the student and faculty experience and development that lead to both personal and professional positive outcomes as well as economic and community development outcomes. Through TRIF funding, we have supported collaborations in business, creative arts enterprises, engineering, health innovation, and sustainability and piloted a number of new initiatives that have since led to additional funding.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> Edson E+I believes in ASU's charter of excellence with inclusion and impact at scale and its design aspirations including valuing entrepreneurship. Edson E+I supports over 50,000 square feet of place-based innovation spaces across five locations. These spaces provide co-working, events and exhibitions, and amenities spaces for emerging ventures and community-based partners including entrepreneur support organizations to convene, network, and strengthen the entrepreneurial community and ecosystem. With academic collaborations, entrepreneurial training and development, and a place-based innovation spaces network as continued resources, Edson E+I has raised \$40.4 million in additional funding including two endowed funds of \$11.5 million over the last five years.				
<b>Is there an Arizona Specific Benefit or Impact?</b> Edson E+I's mission is to serve as the connecting and collaborating resource across ASU and the greater Phoenix community, providing support and material resources for entrepreneurship. In addition to specific place-based engagements and programs, leadership from Edson E+I serve on the boards of StartupAZ, Co+Hoots Foundation, Phoenix Startup Week, AZ Bioscience and others including national organizations such as the Global Consortium of Entrepreneurship Centers (GCEC). We are recognized as a critical community leader by the Greater Phoenix Economic Council, the Arizona Commerce Authority and multiple offices of economic and community development across Greater Phoenix. Edson E+I is a leader in inclusive entrepreneurship and has championed many community-based programs including Prepped and the Kauffman Foundation's Inclusion Challenge.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	400,000	400,000	400,000	1,200,000
Development	400,000	400,000	400,000	1,200,000
Total	800,000	800,000	800,000	2,400,000
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	2	2	2	6
Undergraduate Students	6	7	7	20
Sponsored Project Funding	3,508,580	3,684,009	3,868,209	11,060,798
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**  
 The J. Orin Edson Entrepreneurship + Innovation Institute (Edson E+I) supports academic and community entrepreneurial endeavors, delivering the training, resources and connections to help budding entrepreneurs succeed. As activation and programming increase, more entrepreneurs and aspiring entrepreneurs have access to our place-based innovation spaces for co-working, events, exhibitions and, in some cases, a makerspace to support ideation and creation. With the help of TRIF funds, Edson E+I manages the personnel, operations and programming of over 50,000 square feet of place-based innovation spaces across the Valley, including locations in Chandler, Mesa, Scottsdale and two locations in Phoenix.

In fiscal year 2022, the spaces hosted over 400 events supporting entrepreneurial and training programs as well as community and ASU events. With the opening of 850 Phoenix Bioscience Core (850 PBC) in Downtown Phoenix — a public/private partnership with the Arizona Board of Regents, Arizona State University, Northern Arizona University, University of Arizona and the city of Phoenix — the Health Entrepreneurship Accelerator Lab (HEALab), an interdisciplinary collaboration between Edson E+I, Edson College of Nursing and Health Innovation, College of Health Solutions and New College of Interdisciplinary Arts and Sciences, was relocated and is now housed within the Edson E+I space. HEALab will continue to provide support for health and health care related business ventures.

In addition to HEALab, 850 PBC serves Prepped, an early-stage food business development program for ventures owned by women and underrepresented minorities. 1951@SkySong in Scottsdale continues to serve as a main hub for Edson E+I's Venture Development program, Venture Devils, which focuses on ASU student, faculty, staff and community-based entrepreneurs with an affiliation to ASU. The Venture Devils program supported over 170 new ventures in FY 2022, providing mentorship and access to \$482,000 in funding through Edson E+I endowments and other philanthropic support.

The ASU Chandler Innovation Center (ACIC) in Chandler provides event space and a makerspace supporting programs like the Social Innovation Start Up Lab, a 12-week incubator style course for entrepreneurial ventures aiming at social impact; our Youth Entrepreneurship Design Challenge, geared toward local middle schools; and Teaching with Tech, designed to support middle school teachers. Additionally, ACIC houses an incubator program called Chandler Innovations, supported by the City of Chandler.

The Edson E+I space within Fusion on First in Downtown Phoenix is a student-focused community supported in partnership with Educational Outreach and Student Services, Herberger Institute for Design and the Arts, and various student organizations. Edson E+I provides entrepreneurial programming within the space, such as the Entrepreneur-in-Residence program, an immersive opportunity for local experts to connect with the ASU community and support students with ideas in various stages. This year we hosted Shellye Archambeau, author and strategic advisor; Gaëll Mainguy, director of #LearningPlanet; and Sandra Fujiyama, executive director, Pacific Asian Center for Entrepreneurship at the University of Hawaii.

In partnership with the City of Mesa, The Studios @ Mesa City Center space run by Edson E+I is set to open in late summer 2022, bringing together a mix of businesses, startups and institutions to advance the city's innovation district design with access to Edson E+I's entrepreneurial programming.

Along with site-specific programming, Edson E+I continues to utilize its network of spaces to provide access to programs like Phoenix Start Up Week, a five-day event providing education, networking and support to entrepreneurs, by hosting watch parties across all spaces to support local connection and engagement.

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	399,012			399,012
Development	399,012			399,012
Total	798,024	0	0	798,024

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	53			53
Sponsored Project Funding	11,520,000			11,520,000
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Access and Workforce Development			
Program Name:	The Luminosity Lab			
Problem Statement:				
<p>The current university systems within the United States lack effective student engagement models that provide undergraduate students with meaningful applied research and development opportunities. Opportunities, when they do exist for undergraduates, are often not relevant to the technical and real challenges of the 21st century. As a result, the United States stands to lose its position as the world leader in innovation and R&amp;D.</p>				
Program Description:				
<p>Having designed and successfully launched The Luminosity Lab, a novel model of student-led research and development, Luminosity now aspires to launch a consortium, in which ASU-powered Luminosity labs will be chartered at academic institutions around the country. These labs, powered by ASU, will engage exceptional talent at each hosting institution within our unique model of student-led R&amp;D to focus on moonshot projects and impacting society. These labs will scale ASU's access to student talent, corporate partners and academic institutions across the globe.</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>ASU will retain the IP generated throughout the network and serve as the prime recipient of all sponsored research that is executed within the consortium. This model, which is the first of its kind, will scale ASU's patent numbers and sponsored research dollars exponentially. This embedded model is net revenue generating and funded pilots are underway. Each new lab will bring in resources to offset its costs. However, the program will require initial investment to get established and support staffing requirements.</p>				
Is there an Arizona Specific Benefit or Impact?				
<p>This nationwide program will be powered by ASU and its home base will be established within Arizona. Arizona and ASU will benefit tremendously from the expansion of the brand, as well as the resulting IP, talent and corporate partnerships. Our hope is to make Arizona the home for all spinout companies that are generated from this national innovation network.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	166,667	166,667	166,667	500,000
Applied Research	166,667	166,667	166,667	500,000
Development	166,667	166,667	166,667	500,000
Total	500,000	500,000	500,000	1,500,000
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	1	1	2	4
Undergraduate Students	12	13	14	39
Sponsored Project Funding	139,851	146,844	154,186	440,881
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**  
 Fiscal year 2022 was one of growth and expansion for the Luminosity Lab. We leveraged our TRIF funds to staff and successfully launch the Luminosity Consortium, which aims to spread our model of student-driven innovation across the globe. The consortium will create new applied research and development opportunities for students all over the world, and ASU will retain any intellectual property generated and remain the primary recipient of sponsored research, reinvesting in our state.

This year, we were able to send a staff member to Lane College, a Historically Black College in Jackson, Tennessee, to launch the 20-student lab. Lane students advanced their skills while working on applied projects with companies such as Emes Project LLC, an offshoot of the Howard Shultz Family Foundation. Luminosity at Lane also worked on multiple projects to positively impact their local community, from proposing sustainable advancements of local transportation systems, to building a mobile engagement app for their college. Their sustainability work has led to FedEx, headquartered nearby in Memphis, to make a \$300,000 investment in Luminosity at Lane to advance sustainability efforts at their school.

We continued to support Luminosity at Kwame Nkrumah University of Science and Technology in Ghana and launched another Luminosity Lab at Wentworth Institute of Technology in Boston. At the end of 2021, we brought Luminosity students from around the world to Tempe to meet and share their research and development projects.

In addition to scaling Luminosity's model to universities, we piloted a high-school level Luminosity at Hamilton High School in Chandler, Arizona. This effort has synergized with our newly received endowment to provide scholarships to incoming high school students to join a new Luminosity program aimed at providing opportunities to students with high financial need.

Overall, in FY 2022 we have been able to directly impact the lives of approximately 100 students by scaling the consortium. Additionally, the research and development efforts these students have conducted will have direct, positive impacts on the communities they live in. The projects the students worked on include: a smart fire alarm system for underdeveloped countries, a novel water filtration system, a campus engagement app, a proposed sustainable inter-campus transit system, a microgrid energy system designed to support underdeveloped countries, a smart notetaking app that won first place in Red Bull's global innovation challenge, a road safety technology, an artificial intelligence tool to combat disinformation, and a system to help recycle and reuse plastic materials.

Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research	169,365			169,365
Applied Research	169,365			169,365
Development	169,365			169,365
Total	508,095	0	0	508,095

Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	3			3
Undergraduate Students	33			33
Sponsored Project Funding	990,000			990,000
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Access and Workforce Development			
Program Name:	Vice President for Research			
<b>Problem Statement:</b>				
When faculty are developing proposals, evaluation plans are often required, yet many faculty do not have the expertise to create a comprehensive and competitive evaluation component. However, having a well-developed evaluation plan aligned with educational and broader impact goals is an essential component needed to secure funding for sponsored projects.				
<b>Program Description:</b>				
CREST (College Research and Evaluation Services Team) within the ASU Knowledge Enterprise provides technical assistance and evaluation planning at the pre-award stage at no cost to faculty members and staff. CREST includes three full-time evaluation professionals with advanced degrees, graduate level training in evaluation and global experiences in evaluation methods. Expertise includes quantitative and qualitative analysis data collection for needs assessments, implementation and impact evaluations. CREST currently supports the evaluation of 29 projects totaling over \$50 million in funding from the National Science Foundation, U.S. Department of Education, National Institutes of Health, the ASU Foundation, and state and national philanthropic organizations.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b>				
CREST completed evaluation sections of 59 grant proposals over FY21. This same level of work is expected in FY22. The total potential revenue generated through funding if all grants were awarded would be over \$25 million.				
<b>Is there an Arizona Specific Benefit or Impact?</b>				
With the grant funding on projects, the overwhelming majority need to provide educational services to K-16 students. These students primarily reside within Arizona and receive free, high-quality educational outreach they may otherwise not have had available. K-12 teachers from Arizona also have opportunities to participate in paid professional development to increase their pedagogical skills and technical knowledge to bring back to their classrooms.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	140,000	140,000	140,000	420,000
Development	140,000	140,000	140,000	420,000
Total	280,000	280,000	280,000	840,000
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	100	105	110	315
Sponsored Project Funding	362,414	380,535	399,562	1,142,511
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Access and Workforce Development			
Program Name:	Vice President for Research			
2022 Progress Summary:				
<p>Over the course of FY 2022, CREST assisted with 60 proposals by providing evaluation plans free of charge to faculty, promoting award success and elevating the expertise of our researchers. These proposals totaled \$98,163,665.00. Currently, seven proposals have been awarded for a total of \$7,883,935.00. Twelve have been declined for funding and the others are still pending. Proposals were submitted to the National Science Foundation, National Institutes of Health, USAID, U.S. Department of Education, U.S. Department of Energy, Department of Defense, National Oceanic and Atmospheric Administration, Arizona Department of Education, Arizona Governor's Office and internal ASU grants. Further, CREST supports the evaluation of 33 grants within ASU and three grants at other universities (University of Pennsylvania, University of Pittsburgh, Carnegie Mellon University and Stanford University).</p> <p>CREST participated in the evaluation of multiple NSF CAREER grants, assisting early career faculty in evaluating the broader impacts of their programs on K-12 students. For example, for Daniel Aukes, CREST evaluated student learning outcomes of his hands-on, experiential summer robotics camp for high school students interested in pursuing high-demand robotics careers and learning how robotics principles are applied to solve real-world problems. In Abishek Singharoy's grant, CREST examined how an interactive biotechnology program using high-powered computer systems not typically available outside of universities would increase knowledge and interest in the field with a group of high school students.</p> <p>CREST provided evaluation services for NSF and U.S. Department of Education funded professional development opportunities for in-service teachers, including Research Experience for Teachers (RET), Computer Science for All Researcher Practitioner Program (RPP), Innovative Technology Experiences for Students and Teachers (ITEST) focused on artificial intelligence and visual programming, and a grant supporting culturally relevant instruction in community college classrooms within HSIs (Hispanic Serving Institutions). These programs do the following for teachers and their students in Arizona: provide hands-on research experience that translates into K-14 curriculum; expose AZ students to STEM in ways that are more tangible and tied to "real-world" issues; better equip teachers to promote/encourage STEM career opportunities to their students in academia, industry and government positions; and allow teachers to share their research experiences and develop curriculum/lesson plans with other teachers and administrators in their schools.</p> <p>In addition to K-14 teachers and community college professors, CREST examines programs directly supporting undergraduate success in STEM programs by providing evaluation support. These include Research Experiences for Undergraduates (REU), International Research Experiences for Students (IRES) and an NIH Environmental Health Science Scholars summer program. These programs are designed to provide students with hands-on research experiences, increasing their knowledge and skills in the field and their motivation to pursue a STEM career. CREST oversaw the evaluation of the Presidential Scholars Graduate Assistantship (PGA) and Post-doctoral Fellowship (PPF) programs, a merit-based program to recruit and mentor BIPOC doctoral students who have great potential to move on to advanced academic and private sector careers. This initiative encourages career growth and professional development of underrepresented graduate-level students. The evaluation provided data to the President's Office with recommendations for continuing best practices and decreasing barriers for the cohort. CREST also works with programs across campus that assist first-generation and high-financial-need college students with academic, social and financial support. These include the NSF Scholarships in Science, Technology, Engineering, and Math (S-STEM); U.S. Department of Education's College Assistance Migrant Program (CAMP); and ASU-funded programs such as the Parsons Scholarship Program for DACA students, the Nina Scholars Program for former foster care students, and the CRIPIT program for low-income students. The evaluation provided data to the President's Office with recommendations for continuing best practices and decreasing barriers for the cohort.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	126,753			126,753
Development	126,753			126,753
Total	253,506	0	0	253,506
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	10			10
Graduate Students	152			152
Undergraduate Students	62			62
Sponsored Project Funding	450,854			450,854
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Access & Workforce Development			
Program Name:	Research Development			
<b>Problem Statement:</b> Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.				
<b>Program Description:</b> Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.				
<b>Is there an Arizona Specific Benefit or Impact?</b> ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	60,306	60,306	60,306	180,917
Applied Research	60,306	60,306	60,306	180,917
Development	60,306	60,306	60,306	180,917
Total	180,917	180,917	180,917	542,751
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	40,000,000	42,000,000	44,100,000	126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University
TRIF Investment Area:	Access & Workforce Development
Program Name:	Research Development

**2022 Progress Summary:**  
 Research Development (RD) hosted 39 events during FY 2022 across four categories with 977 in-person attendees. We reached 386 faculty in FY 2022, 54 more than in FY 2021. Research Development supported 20 full proposals and 14 preliminary proposals in FY 2022, with an overall potential total value of \$687 million. We provided graphic support to 23 proposals, worth a potential value of \$557 million. Strategic intelligence provides analysis to inform strategic decision-making by ASU leaders. In FY 2022, they produced 81 documents overall, with the majority of these being program analyses (26). Program analyses focus on specific funding opportunities that are of high interest to the ASU community. The analysis provides background (past award history) and foreground (capacity at ASU) to increase the competitive nature of proposals designed by ASU investigators. In addition, they produced 18 capacity analyses, which are designed to identify intellectual capacity at the university so that it can be harnessed to pursue large and strategic initiatives. RD disseminated 219 funding opportunities across multiple sponsors. Our internal review program was used for 13 highly competitive opportunities. The transparent, equitable review of applications results in increasing the positioning of subsequent applications to the sponsor agency. This year, the program was able to coordinate 50 faculty and provide robust, timely feedback to all applicants. Note: sponsored funding listed in the metrics are proposals not awards.

**Access and Workforce Development highlights**

- RD produced a program analysis of DOD education programs for the Global Security Initiative.
- RD hosted several events around workforce development funding opportunities, including the NSF Regional Innovation Engine, the NSF Research Traineeship, multiple Early Career funding programs, the NSF Mid-Career Advancement, DOE Early Career programs, the NSF Major Research Instrumentation, and the EDA Build Back Better Regional Program. There were almost 1,000 registrations for all events in this category.
- RD holds regular workshops on identifying funding opportunities, writing proposals and creating strategy around increasing competitive positioning. RD hosted nine events in this category, with 759 registrations.
- RD supported one proposal to the EDA with a potential of \$20 million award.
- RD supported an \$80 million proposal to the NSF that, if successful, will fund an extensive construction effort at the Biodesign Institute. The instrument is poised to contribute to significant advances in science.

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research	78,851			78,851
Applied Research	78,851			78,851
Development	78,851			78,851
Total	236,553	0	0	236,553

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	212,078,593			212,078,593
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Access & Workforce Development			
Program Name:	Skysong Innovations			
<b>Problem Statement:</b> ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.				
<b>Program Description:</b> SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). Other U.S. universities in the top 10 include MIT, Stanford, and Caltech. Tsinghua University in Beijing was the only non-U.S. university to surpass ASU on the global list. In FY20, ASU researchers working with SI continued to set new benchmarks, submitting 306 invention disclosures and launching 19 new startups. ASU startups also raised more than \$120 million in external funding in FY20.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly \$1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and – in some cases – even take positions running these startups. SI is also the ASU lead behind the ASU-Mayo MedTech Accelerator, which brings together the recognized world leader in <del>patient care, education, and research</del>				
<b>Is there an Arizona Specific Benefit or Impact?</b> SI annually commissions the Seidman Research Institute to perform an economic impact analysis of ASU's tech transfer activities. The most recent report found that from 2016-2020, as a result of the operations of SI and the Arizona-based, ASU-linked companies, Arizona's economy gained a cumulative \$717.8 million in gross state product, \$477.9 million in labor income, 7,059 job years and \$64 million in state and local tax revenues. By 2025, Seidman projects the economic impact of SI and these ASU-linked companies will exceed \$2.3 billion, with the vast majority of that impact in Arizona.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	19,466	19,466	19,466	58,397
Applied Research	19,466	19,466	19,466	58,397
Development	19,466	19,466	19,466	58,397
Total	58,397	58,397	58,397	175,192
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	0	0	0	0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	5	5	5	15
Startup Investments	100,000,000	105,000,000	110,250,000	315,250,000
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

### 2022 Progress Summary:

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

In FY 2022, SI continued its trend as a highly productive, impactful technology transfer organization, capturing 305 new ASU innovations and securing 164 new U.S. patents. Additionally, SI closed 57 new licensing deals — not accounting for many other innovations licensed to industry partners in the context of research collaborations. Within these licensing activities, SI advanced the launch of 21 new startup companies founded upon ASU innovations ranging from new vaccines to safer battery technologies. Of the 21 new companies, 18 are based in Arizona. Notably, these output levels for innovations, patents, licensing deals and startups have historically placed ASU within the top 10 (and in some instances the top 5) among universities without medical schools, according to data published by the Association of University Technology Managers. ASU was one of only five such universities to rank in the top 10 across all four categories — along with Caltech, MIT, Purdue and North Carolina State.

FY 2022 was also a milestone year for ASU startup fundraising efforts. For the first time, the historical running total of venture capital investments and other funding reported by all ASU startups surpassed the \$1 billion mark.

SI commissioned the Seidman Research Institute to perform an economic impact analysis of ASU's technology transfer activities. The report concluded that, due to the operations of SI and Arizona-based, ASU-linked companies from 2016 through 2021, Arizona's economy gained a cumulative \$851 million in gross state product, \$565 million in labor income, \$76 million in state and local tax revenues, and 8,125 job-years (where one job year is the equivalent of a person having a full-time job for one year). By 2026, Seidman projects the economic impact of SI and these ASU-linked companies will exceed \$2.9 billion, with most of that impact — \$1.6 billion — realized in Arizona.

### Investment Detail

	2022	2023	2024	Total
Infrastructure				0
Basic Research	19,466			19,466
Applied Research	19,466			19,466
Development	19,466			19,466
Total	58,398	0	0	58,398

### Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	0			0
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	3			3
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Improving Health			
Program Name:	Biodesign Institute			
Problem Statement:	<p>Emergent global challenges in medicine, environmental sustainability and national security continue to threaten the health of our communities and our planet. The Biodesign Institute at Arizona State University is committed to solving such challenges by developing rigorous, collaborative, nature-inspired science for the benefit of all life on Earth. By leveraging TRIF investment, Biodesign improves health, ensures security, sustains the planet and provides access and workforce development opportunities.</p>			
Program Description:	<p>As the premiere scientific research institute in one of the nation's fastest-growing research universities, the Biodesign Institute addresses an expansive array of global challenges by creating nature-inspired solutions to address society's greatest challenges in biomedical health, environmental sustainability and national security. Biodesign is poised to promote workforce and leadership development with academic and hands-on, laboratory enrichment experiences and education to advance research, technology and thought leadership in the state of Arizona, and to elevate and expand Arizona's highly skilled workforce. Voter-supported investment in university research pioneered at Biodesign allocates resources to promote access to highly skilled experts and technologies in state-of-the-art laboratories for high-impact research of societal value. In this way TRIF funding is a powerful driver of scientific excellence and enables multiple pathways to enrich the economy through higher education access for workforce development, with ASU Biodesign-specific programs in impactful areas.</p>			
What is the University's Advantage and/or Anticipated Funding Opportunities?	<p>The ASU advantage for additional funding opportunities are many, including: 1. Expansion of COVID-19 testing success to a more generalized platform for developing new ways to rapidly diagnose and detect disease. 2. Expansion of the Neurodegenerative Disease Research Center (NDRC) under the leadership of Jeff Kordower. 3. In partnership with the ASU School for Complex Adaptive Systems, expand efforts in cybersecurity, artificial intelligence, deep learning and computational biology to reduce internet security threats and measure the impact of censorship on internet architecture. 4. Leverage TRIF funding to enable the formation of spinout companies. 5. Established the Biodesign Center for Sustainable Macromolecular Materials and Manufacturing (BCSM3) to focus on sustainable manufacturing and polymer chemistry, with goals of generation of sustainable, environmentally friendly materials.</p>			
Is there an Arizona Specific Benefit or Impact?	<p>Biodesign is committed to the creation, development and deployment of impactful programs to improve human health and economic opportunity in Arizona. TRIF funding to the Biodesign Institute would enhance the workforce and impact health in many areas, including: 1. Through Compact X-ray free electron laser/compact X-ray light source student internships, train the next generation of X-ray machinists, technologists and physicists. 2. Through internships and fellowships in the ASU Biodesign Clinical Testing Laboratory (ABCTL), train and educate workers to seek new technologies and solutions to respond to potential infectious viruses such as COVID-19 and its various strains. 3. Develop Biodesign workforce training opportunities in semiconductor science and sustainable manufacturing.</p>			
Investment Detail	2022	2023	2024	Total
Infrastructure	3,304,222	3,304,222	3,304,222	9,912,666
Basic Research	0	0	0	0
Applied Research	2,138,000	2,138,000	2,138,000	6,414,000
Development	2,138,000	2,138,000	2,138,000	6,414,000
Total	7,580,222	7,580,222	7,580,222	22,740,666
Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	95	100	105	300
Graduate Students	415	436	458	1,309
Undergraduate Students	159	167	176	502
Sponsored Project Funding	56,867,053	59,710,405	62,695,925	179,273,383
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	113,193	118,852	124,795	356,840
Startups	4	4	5	13
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**  
 The Biodesign Institute, launched in 2004 through support from TRIF, continues to expand its activities and impact. In FY 2022, the institute reported \$92 million in sponsored project research expenditures and submitted \$313.8 million in proposals.

Biodesign's Clinical Testing Laboratory (ABCTL) received accreditation from the College of American Pathologists (CAP), the nation's largest organization of board-certified pathologists, after a rigorous onsite inspection. ABCTL has completed over 1.39 million COVID-19 PCR tests since beginning operations in mid-2020.

Biodesign Professor Efreem Lim used an innovative approach of high-throughput viral sequencing and functional studies of viral components focusing on genomic surveillance studies of SARS-CoV-2 (the virus that causes COVID-19) and its emergent variants. Lim won a \$7.1 million grant from the Arizona Department of Health Services for "Monitoring Sequence Variation of SARS CoV-2 in Arizona." His research group sequenced the first SARS CoV-2 cases in Arizona and subsequently identified B.1.243.1, a homegrown variant. This mutation in the virus' spike protein is known to reduce neutralization by post-vaccination blood transfusion and monoclonal antibody therapeutics.

Biodesign Center for Mechanisms of Evolution faculty member John McCutcheon became ASU's first Howard Hughes Medical Institute Investigator in September 2021. This prestigious award provides \$9 million in external funding over seven years with the potential of renewal for a second seven-year period. We were successful at recruiting McCutcheon to ASU in 2020 thanks to TRIF funding. His research seeks to use bacteria as models for understanding mitochondria, which are responsible for energy management in human cells.

The Michael J. Fox Foundation awarded three grants totaling \$5.2 million to ASU to study pioneering treatments for Parkinson's disease. The awards fund research led by Jeffrey Kordower, director of the ASU-Banner Neurodegenerative Disease Research Center in the Biodesign Institute.

Biodesign's Center for Sustainable Macromolecular Materials and Manufacturing won an NSF Emerging Frontiers in Research and Innovation (EFRI) award together with a Research Experience and Mentoring (REM) supplement, permitting a promising group of undergraduate researchers to be paired with graduate student mentors for a summer research experience. This includes a visit to the City of Phoenix Public Works site to learn to tackle the biggest challenges in plastics recycling.

Biodesign faculty member Abhishek Singharoy is developing the BioSense Network, a virtual curriculum to introduce current topics in biotechnology to teachers. Singharoy won a \$1.4 million National Defense Education Program grant from the U.S. Department of Defense for the program. The grant allows the group to develop lessons that use virtual simulations, train teachers to use these materials, and build an online platform to bring the BioSense Network to diverse student populations throughout Arizona.

Biodesign scholars filed 70 patents and had 39 U.S. patents issued in FY 2022. Issued patents include:

- Use of microbiota transfer therapy to manage autism spectrum disorder.
- A rapid, inexpensive method for detection of Valley Fever using simple lab systems.
- A novel bioreactor that uses bacteria to produce valuable chemicals from "syngas."
- A novel method to reduce undesired immune response in a patient treated with gene editing therapies.

Investment Detail	2022	2023	2024	Total
Infrastructure	3,270,007			3,270,007
Basic Research	0			0
Applied Research	2,115,861			2,115,861
Development	2,115,861			2,115,861
Total	7,501,729	0	0	7,501,729

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	121			121
Graduate Students	488			488
Undergraduate Students	212			212
Sponsored Project Funding	57,191,622			57,191,622
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	327,121			327,121
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Improving Health			
Program Name:	Research Computing			
Problem Statement:				
<p>The process of discovery is directly driven by the scale and pace of available simulation and analysis capacity on campuses. Research projects within Arizona increasingly rely on foundational and advanced research computing. Over 80% of the top-funded researchers at each of the state institutions are currently supported through research computing infrastructure and services. This percentage continues to increase as more research funding opportunities require not only research computing but also systematic support for data controls and regulations. Positioning our researchers for success in health, medical, defense and next-generation technologies research requires a scale of support only available at the statewide level, providing enhanced collaborative capability across all three universities.</p>				
Program Description:				
<p>ASU Research Computing provides cutting-edge technology to support research and education while advancing the knowledge and understanding of deploying 21st-century cyberinfrastructure in a large public research university. Specifically, this program supports multidisciplinary research and education in science, technology, engineering and mathematics domains, including computational genomics, molecular dynamics, computational materials science, robotics and imaging. The program increases ASU's capacity for computationally enabled discovery and provides a federated access mechanism for extramural resource sharing across Arizona. Partnering with Dell Technologies, the ASU Research Computing Core Facility has established the ASU Center of Excellence in High Performance Computing and Artificial Intelligence. One of only three such centers in the United States, Research Computing currently enables nearly \$1 billion in proposals and nearly \$300 million in awards.</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>Investment in Research Computing will unify, broaden and overarchingly lift all advanced computing capabilities across the state. Notably, investment of TRIF funds in this program will:</p> <ul style="list-style-type: none"> <li>- Directly enable ASU proposals totaling \$2 million per year.</li> <li>- Precipitate large-scale federal infrastructure awards.</li> <li>- Increase percent conversion of faculty who have consumed research computing resources.</li> <li>- Increase engagement via training events reaching over 1,000 participants per year.</li> <li>- Shorten the time to achieving transformational research and scientific discovery.</li> </ul>				
Is there an Arizona Specific Benefit or Impact?				
<p>Research Computing has developed capacities in advanced computing and data for initiatives in health, sustainability, space exploration, national security and workforce development that directly benefit Arizona industries. Examples include:</p> <ul style="list-style-type: none"> <li>- Federally regulated secure computing environment for the Global Security Initiative.</li> <li>- Advanced data movement network for the Lunar Reconnaissance Orbiter Camera.</li> <li>- Developing the Health Futures Computational Facility in partnership with Mayo Clinic.</li> <li>- Exploring workforce development opportunities in our tribal communities and identifying solutions to accessing technological resources.</li> </ul>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	765,000	765,000	765,000	2,295,000
Applied Research	765,000	765,000	765,000	2,295,000
Development	765,000	765,000	765,000	2,295,000
Total	2,295,000	2,295,000	2,295,000	6,885,000
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	110	116	121	347
Graduate Students	633	665	698	1,996
Undergraduate Students	217	228	239	684
Sponsored Project Funding	47,441,365	49,813,433	52,304,105	149,558,903
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	122,053	128,155	134,563	384,771
Startups	3	3	3	9
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

### 2022 Progress Summary:

The ever-increasing utilization of ASU Research Computing demonstrates the broad need for high-performance computing resources and technology solutions to our research community. FY 2022 saw the highest supercomputing system utilization on record, with over 96,000,000 CPU hours of computing — a 20% year-over-year increase — delivered to over 1,500 unique users — a 50% increase — across more than a dozen distinct colleges. This high usage translates to Research Computing resources supporting 117 proposals totaling \$106,309,343 and 87 awards with \$14,733,486 in expenditures in FY22.

In the spring of 2022, Research Computing launched the Sol Supercomputer, funded through the Office of the President and the University Technology Office's Information Technology Bond and co-designed by Dell Technologies. As a Dell Technologies High Performance Computing and Artificial Intelligence Center of Excellence, ASU leveraged a close relationship with the computer and software giant to design and fabricate the new supercomputer. Multiple academic and industry counterparts also contributed to Sol's design and specifications. Sol will allow ASU to expand its suite of large-scale computing services to further advance research and learning across the university and the region. Sol includes 18,000 state-of-the-art CPUs, increasing ASU's computing power and positioning Research Computing to deliver over 200,000,000 CPU hours of computing capacity each year.

ASU is one of five regional sites operating the advanced computing systems that make up Jetstream 2, a national cloud computing system funded by the National Science Foundation and designed to enable new research, discovery and innovation across a broad range of disciplines. The Jetstream2 system at ASU launched in May 2022.

In FY 2022, Research Computing submitted nine federal funding proposals for activities including training and workforce development in computational science, the establishment of a cyber professional society, training for cybersecurity professionals, and private cloud research computing systems.

In 2022 Research Computing will host its second annual Research Computing Expo featuring a keynote speech from computer science pioneer and Arizona resident John Gustafson. This event typically attracts more than 100 attendees and showcases the research impacts of advanced computing in Arizona.

With funding from TRIF, ASU Research Computing has made significant contributions to research, innovation and discovery across many disciplines. Through the use of ASU Research Computing systems, the Arizona research community is publishing compelling scientific results, advancing useful, fundamental research, and attracting new federal research dollars.

### Investment Detail

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

### Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	137			137
Graduate Students	872			872
Undergraduate Students	334			334
Sponsored Project Funding	47,601,576			47,601,576
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	100,000			100,000
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Improving Health			
Program Name:	ACCEL (Arizona Coalition for Comprehensive Evaluation of Long-COVID)			
<b>Problem Statement:</b> There is growing recognition that survivors of COVID-19 infection are vulnerable to developing a wide range of post-infection problems (known as long-COVID) of unknown duration with implications for long-term care costs and disabilities affecting capacity to work. Long-COVID affects the cardiovascular system, lungs, joints, skin, GI tract and brain with widely differing effects in different individuals. There is an urgent need for new diagnostic tests and clinical assessment tools to predict which patients will develop Long-COVID and their prognosis.				
<b>Program Description:</b> The Arizona Coalition for Comprehensive Evaluation of Long-COVID (ACCEL) is a multi-institution consortium led by ASU's Complex Adaptive Systems Initiative (CASI), in partnership with Abrazo Health, Dignity Health, Honor Health, Mayo Clinic, Valleywise Health, Veterans Administration, Arizona Department of Health Services, HealthCurrent, NAU, TGen-North and multiple units at ASU (Biodesign Institute, College of Health Solutions, Southwest Interdisciplinary Center (SIRC), College of Public Service and Community Solutions). Its goal is to establish collaborative research on COVID-19 immune responses to predict individuals at risk of severe COVID-19, death or development of long-COVID. CASI's role as founding sponsor of National Biomarker Development Alliance established protocols for biobanking of samples for multiOmics and standardized data formats for multi-institution data exchange that have been adopted by the ACCEL project				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> The scale of the patient populatoin suffering from long-COVID and its statewide impact will benefit from mobilizing tri-unviersity resources to generate the spectrum of clinical, research and computing skills required. Long-COVID is attracting major federal funding. ASU and and the Institute for Future Health (a joint program of ASU and the University of Arizona) have strong competitive assts to pursue these fundign sources and provide a robust return on investment.				
<b>Is there an Arizona Specific Benefit or Impact?</b> Over 1 million Arizonans have been infected with COVID-19. Over 70,000 have been hospitalized and 18,000 have died. Based on the incidence of long-COVID across the U.S. and undected infections, the nation is potentially facing a formidable public health challenge of up to 1 million chronically ill individuals. Arizona will face a proportional burden and will need to mobilize new speciality clincis to meet the needs of these patients. Discovery of new diagnostic biomarkers as part of this project offers opportunities to develop intellectual property to promote collaborations with industry for commercialization and royalty revenues.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	712,323	712,323	712,323	2,136,970
Applied Research	712,323	712,323	712,323	2,136,970
Development	712,323	712,323	712,323	2,136,970
Total	2,136,970	2,136,970	2,136,970	6,410,910
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	54	56	59	169
Graduate Students	254	266	280	800
Undergraduate Students	110	116	121	347
Sponsored Project Funding	253,962	266,660	279,993	800,615
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Improving Health			
Program Name:	ACCEL (Arizona Coalition for Comprehensive Evaluation of Long-COVID)			
2022 Progress Summary:				
<p>The ACCEL proposal was not awarded to ASU, so the funding for this category supported broader efforts in the joint ASU-UA Institute for Future Health (IFH), which aims to improve health care and health outcomes for all Arizonians. In FY 2022, IFH signed an MOU with Philips, the multinational health technology company, for two pilot projects that will launch in late 2022:</p> <ul style="list-style-type: none"> <li>• Remote health monitoring for early detection of infections in health care personnel.</li> <li>• In-home monitoring of adults with congestive heart failure and children with asthma for earlier detection of clinical deterioration and faster intervention to reduce high-cost rehospitalizations, supported by a \$410,000 grant from Science Foundation Arizona.</li> </ul> <p>In collaboration with the Biodesign Institute and Dignity Health, IFH launched a project to evaluate immune dysregulation in long-COVID, with particular emphasis on autoimmune responses and HLA histocompatibility genetics as factors that predispose individuals to long-COVID, supported by a \$120,000 grant from the Virginia G. Piper Trust.</p> <p>There is increasing evidence that cardiac dysfunction in up to 12% of congestive heart failure patients may be due to accumulation of amyloid (amyloidosis) in the heart muscle. This creates new opportunities for early detection, collaboration with pharmaceutical companies conducting clinical trials and physician education. IFH launched a pilot project with UA Tucson to identify at-risk patient cohorts as a resource for new blood-based biomarker profiling for amyloidosis risk. The team also received a grant from Pfizer to organize a workshop on cardiac amyloidosis and creation of a Continuing Medical Education course on this topic.</p> <p>IFH is collaborating with UA and Yoo and Co. on a GPEC-led National Science Foundation proposal to accelerate deployment of advances in sensors for remote health monitoring. The goal is to build a Digital Care Innovation Engine with emphasis on high-risk, high-cost, high-complexity patients and to reduce health disparities in the Latinx population in metro Phoenix and underserved rural communities. The NSF invited the consortium to submit a full proposal for \$160 million over five years.</p> <p>IFH convened faculty from ASU, UA, NAU, Midwestern, TGen North and Arizona Department of Health Services to explore formation of the Southwest Biosecurity Consortium, a pan-Arizona enterprise that can competitively compete for anticipated increased funding for pandemic preparedness and related biosecurity challenges. The U.S. Southwest faces several unique infectious disease threats (Valley Fever, West Nile) and new health risks associated with expanded geographic range of infectious disease vectors created by warming temperatures and public health challenges from Arizona's status as a border state and assimilation of large number of migrants (TB, STDs, antibiotic resistant infections).</p> <p>IFH is collaborating with Cowper LLC to explore a platform for accelerated design of vaccines against novel pathogens and improved prediction of likely immune escape landscapes in the evolution of new variants from known pathogens. The work would combine predictive computational modeling with Cowper's immunoprofiling platform.</p> <p>IFH, in collaboration with the ASU School for the Future of Innovation in Society and Crossbow Analytics LLC, submitted a proposal to the Naval Information Warfare Center to study technology trends and risks from the use of synthetic biology to design of novel biowarfare agents.</p> <p>IFH co-director George Poste continued to serve on the Bipartisan Commission on Biodefense in Washington, D.C. The commission issued three reports to Congress in the past year. Poste is also co-signatory, with leaders from the public health and biosecurity communities, on recommendations to White House National Security Council, OSTP and National Science Advisory Board for Biosecurity</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research	453,381			453,381
Applied Research	453,381			453,381
Development	453,381			453,381
Total	1,360,143	0	0	1,360,143
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	3			3
Graduate Students	26			26
Undergraduate Students	19			19
Sponsored Project Funding	2,169,262			2,169,262
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Improving Health			
Program Name:	Skysong Innovations			
<b>Problem Statement:</b> ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.				
<b>Program Description:</b> SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). In FY20, ASU researchers working with SI continued to set new benchmarks, submitting 306 invention disclosures and launching 19 new startups. ASU startups also raised more than \$120 million in external funding in FY20. Moreover, when the COVID-19 pandemic first emerged, SI began fast-tracking innovations to prevent, diagnose or treat the disease. To date, SI has licensed eight ASU-developed COVID technologies to companies.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly \$1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and – in some cases – even take positions running these startups. SI is also the ASU lead behind the ASU-Mayo MedTech Accelerator, which brings together the recognized world leader in <del>patient care, education, and research</del>				
<b>Is there an Arizona Specific Benefit or Impact?</b> SI annually commissions the Seidman Research Institute to perform an economic impact analysis of ASU's tech transfer activities. The most recent report found that from 2016-2020, as a result of the operations of SI and the Arizona-based, ASU-linked companies, Arizona's economy gained a cumulative \$717.8 million in gross state product, \$477.9 million in labor income, 7,059 job years and \$64 million in state and local tax revenues. By 2025, Seidman projects the economic impact of SI and these ASU-linked companies will exceed \$2.3 billion, with the vast majority of that impact in Arizona.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	490,538	490,538	490,538	1,471,613
Applied Research	490,538	490,538	490,538	1,471,613
Development	490,538	490,538	490,538	1,471,613
<b>Total</b>	<b>1,471,613</b>	<b>1,471,613</b>	<b>1,471,613</b>	<b>4,414,840</b>
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	0	0	0	0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	5	5	5	15
Startup Investments	100,000,000	105,000,000	110,250,000	315,250,000
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

### 2022 Progress Summary:

In FY 2022, Skysong Innovations (SI) continued its trend as a highly productive, impactful technology transfer organization, capturing 305 new ASU innovations and securing 164 new U.S. patents. Additionally, SI closed 57 new licensing deals — not accounting for many other innovations licensed to industry partners in the context of research collaborations. Within these licensing activities, SI advanced the launch of 21 new startup companies founded upon ASU innovations ranging from new vaccines to safer battery technologies. Of the 21 new companies, 18 are based in Arizona. Notably, these output levels for innovations, patents, licensing deals and startups have historically placed ASU within the top 10 (and in some instances the top 5) among universities without medical schools, according to data published by the Association of University Technology Managers. ASU was one of only five such universities to rank in the top 10 across all four categories — along with Caltech, MIT, Purdue and North Carolina State.

SI's productivity in FY 2022 involved many innovations, patents, licensing deals and startups directed at improving health. By way of example, FY 2022 marked the creation of the ASU startup Exodigm, Inc. The company aims to commercialize novel molecule-sensing nanodevices created in the ASU labs of Hao Yan and Rizal Hariadi. Among other health applications, the nanodevices are designed to enable new liquid biopsies for detecting cancer. MagStee Medicals, LLC is another health-care-focused example among the 21 new ASU startups launched in FY 2022. MagStee is advancing a robot-assisted surgical technology created by ASU within Hamid Marvi's lab. The technology deploys robotics to reduce procedure times and human error during surgery.

In another example, SI entered into an exclusive license agreement with biopharma startup VaxSyna, Inc. VaxSyna is deploying vaccine and therapeutics technologies created in Hugh Mason's lab. Equipped with the ASU technologies, the company aims to discover and develop novel plant-produced vaccines and therapeutics for combating pandemic threats, intentionally disseminated pathogens and other diseases.

In yet another representative FY 2022 example, SI worked with ASU researchers James Adams and Rosa Krajmalnik-Brown to file for patent protection covering a pediatric test for autism spectrum disorder. The ASU researchers aim to address the fact that there is currently no widely accepted medical test for autism spectrum disorder.

SI's supportive efforts over many years culminated in an exciting new real-world solution reaching the market in FY 2022. ASU startup company Curtiss Healthcare successfully brought to market a new animal vaccine to protect chickens against a deadly disease called necrotic enteritis. The company is based on technology developed at ASU and other universities by Roy Curtiss.

In addition to SI's core efforts in technology transfer, SI also continued to play a highly active and important core-team role in growing the successful Mayo-ASU MedTech Accelerator. The accelerator is a joint effort arising from the Mayo Clinic and Arizona State University Alliance for Health Care. Working with distinguished physicians, researchers and entrepreneurs, accelerator cohort companies from around the world optimize their offerings, license intellectual property, engage in idea mentoring and develop funding strategies. The

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research	490,538			490,538
Applied Research	490,538			490,538
Development	490,538			490,538
Total	1,471,614	0	0	1,471,614

### Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	0			0
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	6			6
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Improving Health			
Program Name:	Office of Government and Community Engagement			
<b>Problem Statement:</b> Decisions to pursue solutions to most pressing human health challenges are often informed by select organizations and committees with limited access by the broader research community. Moreover, securing federal research funding is highly competitive and becoming more and more challenging. To participate meaningfully in relevant discussions and secure funding to support research, ASU must conduct creative, coordinated efforts to establish the university as a thought leader in policy setting areas and increase federal support for research and research-related activities.				
<b>Program Description:</b> The Office of Government & Community Engagement serves as the liaison to officials and agencies of the U.S. government, state of Arizona, Maricopa County, surrounding municipalities and communities, tribal nations, Mexico and cultural leaders. Our office establishes and maintains communication channels with policy-makers, sponsor agency officials and program staff to effectively represent our research capabilities, infrastructure and organizational strengths. We facilitate participation in priority-setting venues and recognition as a thought leader and valuable contributor to advances in science and technology in the national interest, enabling sustained growth in our research and development pursuits.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> ASU is developing new, cross-disciplinary teams and partnerships that position it well to participate in high-level discussions around use of novel technologies and analytical tools to address more complex health challenges than have been resolved to date. We are already seeing early evidence of realization of the need for such innovative approaches in recent funding opportunities, for which we are getting recognition. With appropriate outreach, ASU's Health Futures Center will provide facilities needed to increase our competitiveness in obtaining funding from the U.S. Department of Health and Human Services, including NIH, CDC, HRSA and PCORI. In addition, coupling our broad biomedical expertise with artificial intelligence and machine learning is already enhancing our ability to compete for large, new funding opportunities that require this interdisciplinarity.				
<b>Is there an Arizona Specific Benefit or Impact?</b> Growth of the microelectronics industry in Arizona and other advanced technologies will be the beneficiaries of increased research efforts that depend on access to these tools, with corresponding positive economic impacts. ASU will also be a source for a highly skilled workforce in these areas, thereby providing a magnet for future industry growth. Arizona is also home to rural and urban communities experiencing disproportionate health disparities based on multiple factors, many of which may be identified using advanced analytical tools such as artificial intelligence, which requires increased federal funding.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	304,000	304,000	304,000	912,000
Development	304,000	304,000	304,000	912,000
Total	608,000	608,000	608,000	1,824,000
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	7,000,000	7,350,000	7,717,500	22,067,500
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**  
 Much of ASU's health research portfolio emphasizes equity, access and commercial translation. Research in our downtown facilities is focused on behavioral health issues and equitable access to health. The Phoenix Bioscience Core, a collaboration among ASU, University of Arizona, Northern Arizona University, the city of Phoenix, the Arizona Board of Regents and private industry, is a crucial component in Arizona's growing biotech industry. 850 PBC, a 227,000-square-foot building opened in 2021, offers wet and dry labs, clinical trial areas, a cardiovascular and exercise physiology lab, and a rehabilitation and motor control lab — the types of high-end facilities and equipment that most startups and many researchers previously were not able to access. Programs using facilities at 850 PBC include ASU's Health Entrepreneurship Accelerator Lab (HEALab), which supports health-related startups; Wexford Innovation Labs (opening in fall 2022), a coworking space for life sciences companies; BacVax, a UA spinoff company studying *Haemophilus influenzae*, a common cause of ear infections; and ASU researchers studying smoking cessation, chronic diseases, hydration and more.

Arizona is home to rural and urban communities experiencing disproportionate health disparities based on multiple factors, many of which benefit from the use of advanced analytical tools such as artificial intelligence and wireless measurement devices. ASU's Health Futures Center, located next to Mayo Clinic's Phoenix campus, is home to the MedTech Accelerator, an ASU-Mayo Clinic initiative that helps medical device and health care IT companies bring their products and services to market. The Health Futures Center is becoming integrated into the 228-acre Discovery Oasis, a Mayo Clinic-led effort to join clinical, academic and industrial expertise together and create an environment in which biomedical research and entrepreneurial activities thrive, improving health technologies and adding to economic growth in Arizona. ASU will also be a source for a highly skilled workforce in this effort, feeding future industry growth.

ASU is advancing a growing microelectronics industry in Arizona, positioning the state as a hub for semiconductor research, development and manufacturing. To meet the increasing workforce needs for this industry, ASU launched the new School of Manufacturing Systems and Networks in the Ira A. Fulton Schools of Engineering, with focus areas in semiconductors, aerospace and defense, medical technology, and energy. Arizona's New Economy Initiative supports the development of five Science and Technology Centers (STCs) at ASU that will position Arizona for national and global leadership. ASU has already launched two of these centers, one focused on advanced manufacturing and another focused on energy and materials.

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	243,879			243,879
Development	243,879			243,879
<b>Total</b>	<b>487,758</b>	<b>0</b>	<b>0</b>	<b>487,758</b>

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	2			2
Graduate Students	11			11
Undergraduate Students	12			12
Sponsored Project Funding	5,566,531			5,566,531
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	National Security Systems			
Program Name:	Global Security Initiative			
Problem Statement:				
<p>Today's national and global security challenges are highly complex and interconnected, including protecting information networks (such as those found in critical infrastructure), optimizing human-robot teams, combatting mis- and disinformation, leveraging massive amounts of complex data for effective decision making, and developing transition pathways to application. These challenges require both developing advanced mission-focused research capabilities and creating novel training environments.</p>				
Program Description:				
<p>ASU's Global Security Initiative (GSI) brings together unique ASU research, education, and programming capabilities to address national and global security challenges. GSI has three pillars of activity: research, education and engagement. The research pillar establishes interdisciplinary teams to work on the most challenging problems in security. Currently, GSI has four centers: Center for Cybersecurity and Digital Forensics (CDF), Center for Human, AI, and Robot Teaming (CHART), Center on Narrative, Disinformation, and Strategic Influence (NDSI), and Center for Accelerating Operational Efficiency (CAOE), a U.S. Department of Homeland Security (DHS) Center of Excellence (COE). GSI also manages the Cybersecurity Education Consortium (CEC), an interface between industry and academia to facilitate a robust talent pipeline for cybersecurity jobs in Arizona and across the nation. In addition, GSI supports ASU's Center for Wireless Information Systems and Computational Architectures (WISCA), which builds novel computational architectures that require significantly less power while improving computational ability.</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>GSI has strategically aligned ASU capabilities with national security needs in cybersecurity, human/AI teaming, analytics and narrative analysis, which has resulted in large-scale externally funded awards and recognition by government and academic partners of ASU's unique strengths in these areas. GSI is also creating a unique role for ASU in the education domain, addressing the need to expand STEM education to ensure our future national security. One of GSI's measures of impact is NSF HERD Department of Defense research expenditures ranking. In the last five years, largely through strategic investment in GSI focus areas, ASU's DoD HERD expenditures grew by more than 50%. Assuming the current investment level and other complimentary university activities, we expect the DoD HERD expenditures to continue to grow another approximately 20% by 2024.</p>				
Is there an Arizona Specific Benefit or Impact?				
<p>GSI is improving state and national cyber-readiness in multiple ways. We provide hands-on learning activities for all skill levels and age groups, including free resources for Arizona's middle school and high school teachers to implement in their classrooms, and a free educational platform that guides emerging members of the cybersecurity community through increasingly sophisticated learning modules. GSI's cybersecurity research is informed by connections with Arizona-based industries, and helps protect the intellectual property of Arizona-based companies and the personal information of citizens of Arizona from cyber-threats.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	1,249,000	1,249,000	1,249,000	3,747,000
Development	1,249,000	1,249,000	1,249,000	3,747,000
Total	2,498,000	2,498,000	2,498,000	7,494,000
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	42	45	47	134
Graduate Students	383	402	422	1,207
Undergraduate Students	140	147	154	441
Sponsored Project Funding	39,723,704	41,709,889	43,795,383	125,228,976
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	37,438	39,310	41,276	118,024
Startups	2	2	2	6
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	National Security Systems			
Program Name:	Global Security Initiative			
2022 Progress Summary:				
<p>In an ever-shifting security landscape, the Global Security Initiative expanded and improved efforts to create human-centric tools and systems that prioritize the mission-centric security and capability needs of sponsors and partners. Over 130 affiliated ASU faculty collaborate with GSI to produce novel solutions, technologies and decision-making tools to address pressing and emergent security challenges. In FY 2022, GSI was recognized for \$28 million in research expenditures and submitted \$97 million in proposals.</p> <p>To address global cybersecurity challenges, GSI combined The Center for Cybersecurity and Digital Forensics and the Cybersecurity Education Consortium into the Center for Cybersecurity and Trusted Foundations, uniting cybersecurity research and education efforts. CTF's \$30 million research portfolio and novel education platforms generate solutions to demanding security problems and create skills-building opportunities for learners at all levels. A \$3.7 million Defense Advanced Research Projects Agency project will help automatically identify and fix behaviors in critical software systems. A three-week training for National Security Agency and U.S. Cyber Command personnel helped improve their cybersecurity skills, using pwn.college, a novel training platform that is available free of charge and has been used by students to identify real-world security vulnerabilities. CTF expanded GSI's efforts to develop Arizona's defense and national security talent pipeline with the launch of a new high school research internship program.</p> <p>GSI delivered no-cost exploratory biotechnology programming to 300-plus high schoolers and a further 400 learned about cybersecurity and online data protection. And in partnership with the Pat Tillman Veterans Center, GSI spearheaded Vets4Tech, placing ASU student veterans in Lawrence Livermore National Laboratory internships, with plans to expand this program to other laboratories and the broader defense sector.</p> <p>GSI's Center for Human/AI/Robot Teaming (CHART) worked with the U.S. Army to create and deliver training on artificial intelligence, machine learning and data science through the Army's Intelligence Center of Excellence at Fort Huachuca, enhancing soldiers' ability to contend with evolving technologies on the battlefield.</p> <p>Early this summer, the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence, hosted their third Grand Challenge Hackathon, pairing homeland security, cybersecurity and critical infrastructure professionals with more than 70 students in an immersive learning environment to analyze and solve real-world homeland security problems. These activities cultivate and reinforce a talent pipeline for the national security sector.</p> <p>A workshop co-hosted by GSI and KE Research Development helped secure \$1.4 million from the National Defense Education Program to develop interactive virtual biotechnology lessons for diverse classrooms around Arizona. Fifteen faculty members learned about DOD's STEM and biotech education priorities and proposal logistics, subsequently generating 13 letters of interest, five full proposals and one award.</p> <p>The Center for Wireless Information Systems and Computational Architectures (WISCA), which seeks to establish Arizona as an industry-leading development hub for the next wireless revolution, advanced communications and other wireless capabilities for national defense. WISCA, which is in the final development phase of a \$20 million DOD-funded project to expand the capabilities of critical wireless defense technologies, secured a \$15 million U.S. Space Force award to advance optical communications capabilities in space and is pursuing additional opportunities in this domain. WISCA faculty continue to work with industry and government entities to commercialize lab-developed technologies, including the Low Cost Threat Emitter, a software-defined radio system for training U.S.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	1,231,677			1,231,677
Development	1,231,677			1,231,677
Total	2,463,354	0	0	2,463,354
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	34			34
Graduate Students	342			342
Undergraduate Students	93			93
Sponsored Project Funding	27,998,805			27,998,805
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	25,625			25,625
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	National Security Systems			
Program Name:	Skysong Innovations			
Problem Statement:				
<p>ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.</p>				
Program Description:				
<p>SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). In FY20, ASU researchers working with SI continued to set new benchmarks, submitting 306 invention disclosures and launching 19 new startups. ASU startups also raised more than \$120 million in external funding in FY20. Moreover, when the COVID-19 pandemic first emerged, SI began fast-tracking innovations to prevent, diagnose or treat the disease. To date, SI has licensed eight ASU-developed COVID technologies to companies.</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly \$1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and – in some cases – even take positions running these startups. SI is also the ASU lead behind the ASU-Mayo MedTech Accelerator, which brings together the recognized world leader in patient care, education, and research.</p>				
Is there an Arizona Specific Benefit or Impact?				
<p>SI annually commissions the Seidman Research Institute to perform an economic impact analysis of ASU's tech transfer activities. The most recent report found that from 2016-2020, as a result of the operations of SI and the Arizona-based, ASU-linked companies, Arizona's economy gained a cumulative \$717.8 million in gross state product, \$477.9 million in labor income, 7,059 job years and \$64 million in state and local tax revenues. By 2025, Seidman projects the economic impact of SI and these ASU-linked companies will exceed \$2.3 billion, with the vast majority of that impact in Arizona.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	110,955	110,955	110,955	332,865
Applied Research	110,955	110,955	110,955	332,865
Development	110,955	110,955	110,955	332,865
Total	332,865	332,865	332,865	998,595
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	0	0	0	0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	5	5	5	15
Startup Investments	100,000,000	105,000,000	110,250,000	315,250,000
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	National Security Systems			
Program Name:	Skysong Innovations			
2022 Progress Summary:				
<p>In FY 2022, Skysong Innovations (SI) continued its trend as a highly productive, impactful technology transfer organization, capturing 305 new ASU innovations and securing 164 new U.S. patents. Additionally, SI closed 57 new licensing deals — not accounting for many other innovations licensed to industry partners in the context of research collaborations. Within these licensing activities, SI advanced the launch of 21 new startup companies founded upon ASU innovations ranging from new vaccines to safer battery technologies. Of the 21 new companies, 18 are based in Arizona. Notably, these output levels for innovations, patents, licensing deals and startups have historically placed ASU within the top 10 (and in some instances the top 5) among universities without medical schools, according to data published by the Association of University Technology Managers. ASU was one of only five such universities to rank in the top 10 across all four categories — along with Caltech, MIT, Purdue and North Carolina State.</p> <p>SI's productivity in FY 2022 involved innovations, patents, licensing deals and startups with direct or potential applications to national security. Supply chain security for food and agricultural products, for example, is becoming increasingly important to national security. In FY 2022, SI supported the launch of a new ASU startup dedicated to advancing a novel solution in this area — DENSEC Inc. The company aims to advance ASU-created technologies that provide inexpensive, spoof-resistant, tamper-resistant, unique identifiers that can be placed directly on individual food items. Additionally, in FY 2022 SI worked with ASU researchers in Michael Kozicki's lab to capture five new innovations and secure eight more issued patents related to the technologies.</p> <p>In another example, in FY 2022 SI entered into an exclusive license agreement with a cybersecurity firm that recently acquired Arizona-based ASU startup Cyber Reconnaissance, Inc. Under the agreement, SI out-licensed several cybersecurity technologies created at ASU within Paulo Shakarian's lab.</p> <p>SI advanced several other national-security-related ASU innovations through its technology transfer process in FY 2022, including: a novel cybersecurity solution that estimates the exploitability of software that could develop over time; a novel cybersecurity defense approach that remains effective against attacks even if the attacker has full knowledge of the defense mechanism; and an in-ear wearable device that monitors physiological parameters and environmental conditions with applications for military personnel.</p> <p>SI also continued providing tech-transfer support to ASU programs such as the National Security Academic Accelerator (NSA2) and the Center for Accelerating Operational Efficiency (CAOE). NSA2 is a National Security Innovation Network (NSIN) program that connects university startups with Department of Defense customers and end-users to create viable, U.S.-based, dual-use-solution companies. In FY 2022, SI advanced the launch of two new Arizona-based startup companies that are participating in the NSA2 program. CAOE develops and applies advanced analytical tools and technologies to enhance planning, information sharing and real-time decision-making in homeland security operations. In FY 2022, SI advanced an airport-security innovation arising from CAOE along its technology transfer process.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research	110,955			110,955
Applied Research	110,955			110,955
Development	110,955			110,955
Total	332,865	0	0	332,865
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	0			0
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	5			5
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	National Security Systems			
Program Name:	Research Development			
<b>Problem Statement:</b> Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.				
<b>Program Description:</b> Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.				
<b>Is there an Arizona Specific Benefit or Impact?</b> ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	41,010	41,010	41,010	123,030
Applied Research	41,010	41,010	41,010	123,030
Development	41,010	41,010	41,010	123,030
Total	123,030	123,030	123,030	369,089
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	40,000,000	42,000,000	44,100,000	126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**

Research Development (RD) hosted 39 events during FY 2022 across four categories with 977 in-person attendees. We reached 386 faculty in FY 2022, 54 more than in FY 2021. Research Development supported 20 full proposals and 14 preliminary proposals in FY 2022, with an overall potential total value of \$687 million. We provided graphic support to 23 proposals, worth a potential value of \$557 million. Strategic intelligence provides analysis to inform strategic decision-making by ASU leaders. In FY 2022, they produced 81 documents overall, with the majority of these being program analyses (26). Program analyses focus on specific funding opportunities that are of high interest to the ASU community. The analysis provides background (past award history) and foreground (capacity at ASU) to increase the competitive nature of proposals designed by ASU investigators. In addition, they produced 18 capacity analyses, which are designed to identify intellectual capacity at the university so that it can be harnessed to pursue large and strategic initiatives. RD disseminated 219 funding opportunities across multiple sponsors. Our internal review program was used for 13 highly competitive opportunities. The transparent, equitable review of applications results in increasing the positioning of subsequent applications to the sponsor agency. This year, the program was able to coordinate 50 faculty and provide robust, timely feedback to all applicants. Note: sponsored funding listed in the metrics are proposals not awards.

**National Security Systems highlights**

- RD presented on three Department of Defense opportunities for funding and also hosted a presentation on working with the Department of Defense. These presentations reached 120 individuals.
- RD produced a funding landscape for the Center on the Future of War, a capacity analysis on statecraft for the McCain Institute for International Leadership and a landscape analysis on disinformation.
- RD supported two proposals to the Department of Defense worth a total potential value of \$300,000. However, these were stage 0 and stage 1 proposals for an ultimate potential award of \$20 million in 2023.

**Investment Detail**

	2022	2023	2024	Total
Infrastructure				0
Basic Research	53,621			53,621
Applied Research	53,621			53,621
Development	53,621			53,621
<b>Total</b>	<b>160,863</b>	<b>0</b>	<b>0</b>	<b>160,863</b>

**Performance Measures**

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	675,000			675,000
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	Global Futures Laboratory Programming			
Problem Statement:	<p>The Emergence of the Julie Ann Wrigley Global Futures Laboratory at ASU is rooted in the conviction that we can and must make a meaningful contribution to ensuring a habitable planet and a future in which well-being is attainable for all mankind.</p> <p>This laboratory draws from ASU's deep commitment to use-inspired research, our ongoing work in sustainability and service to the global community in which we live. We are running out of time on many fronts, and need to address problems with urgency, sometimes within only a few years or decades. Water, Energy and Environmental Systems are key drivers to a more sustainable future.</p>			
Program Description:	<p>This laboratory draws from ASU's deep commitment to use-inspired research, our ongoing work in sustainability and service to the global community in which we live. TRIF funding supports multiple programs focused on new energy systems, decisions systems and water related research.</p>			
What is the University's Advantage and/or Anticipated Funding Opportunities?	<p>The Julie Ann Wrigley Global Futures Laboratory leverages the tools and expertise of transdisciplinary research institutes, centers and facilities across ASU to generate new ideas and solve problems. We work in networks and in close exchange with the people affected by problems to combine knowledge and develop solutions on multiple scales. Our New Energy Systems efforts — carbon capture, synthetic fuels, energy transition — have funding opportunities from the Department of Energy (DOE), Carbon Collect and National Science Foundation (NSF). Our Decisions Systems project — complex systems thinking, convergence research, data visualization and modeling — may attract funding from State Department/USGS, Helios Foundation, Rockefeller Foundation and DOE. Our Water research — building on the Action for Water Equity (AWE) NSF award to create a center-level effort — may draw additional investment from the NSF.</p>			
In an ever-shifting security landscape, the Global Security Initiative expanded and improved efforts to create human-centric tools and Multiple AZ specific benefits and impacts including:	<p>1. Transforming Arizona into a hub of carbon capture and synthetic fuel creation, forging partnerships with Navajo Nation, APS, SRP, and local NGOs support the economic transition from coal to alternative energy sources including support to affected communities. 2. Partnering with cognizant national topic leaders and integrate the data of faculty, State, County, and industry leaders, with the goal to attract \$10 million in funding and establish Arizona as a leader in developing economic resilience and continuity in the face of major disruptions. 3. Significantly expand ASU water initiatives including western water resilience and innovation ecosystem by attracting \$25 million in external funding to improve water sustainability and bring jobs, greater water access and equity to urban and rural communities</p>			
Investment Detail	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	2,643,000	2,643,000	2,643,000	7,929,000
Development	1,321,500	1,321,500	1,321,500	3,964,500
Total	3,964,500	3,964,500	3,964,500	11,893,500
Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	44	46	49	139
Graduate Students	217	228	239	684
Undergraduate Students	148	156	163	467
Sponsored Project Funding	25,819,327	27,110,293	28,465,808	81,395,428
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	2	2	2	6
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University
TRIF Investment Area:	Water, Energy and Environmental Systems
Program Name:	Global Futures Laboratory Programming

**2022 Progress Summary:**

The Julie Ann Wrigley Global Futures Laboratory (GFL) conducts research, develops solutions and collaborates with state and local organizations to ensure that all Arizonans can thrive, particularly in the face of challenges related to energy, water and heat. In FY 2022, GFL reported over \$21 million in sponsored project research expenditures and submitted \$109.5 million in proposals.

The Just Energy Transitions (JET) Center convened multiple community discussions in Joseph City and St Johns, Arizona, to support planning for transitioning these communities from dependence on coal plants for economic viability. One set of these meetings included corporation commission members. Sandra Kennedy, Commissioner at the Arizona Corporation Commission, has now opened a docket on the future of these plants. JET has been selected for an EDA grant to continue this work.

The Center for Energy and Society partnered with Salt River Project to map out the pathways to a clean energy future for Arizona, reducing air pollution and helping AZ manufacturing, which are outlined in the report "Pathways to a Carbon-Neutral Arizona Economy." Center personnel are now participating in the City of Phoenix electric vehicle strategic plan. In May 2022, the Global Futures Laboratory established the Center for Energy Research and Policy to maximize the level of understanding and debate about the key issues affecting energy in the Southwest. The center will be membership/subscriber based and welcomes energy stakeholders of all scales. ASU is also a founding member of Arizona Thrives, a statewide alliance charting a path forward, aligning strategies and efforts as we transition from carbon-based fuels to clean energy.

The new, ASU-based Center for an Arizona Carbon-Neutral Economy was created in partnership with the University of Arizona, Northern Arizona University and Arizona energy providers. Among its first undertakings, the center will pursue creation of a regional clean hydrogen hub. ASU is a national leader in hydrogen research, and has received multiple new grants for hydrogen-related projects. Researchers at ASU have engineered a promising new cyanobacterium that produces hydrogen from photosynthesis.

A world-leading Direct Air Capture technology spun out from ASU into the company Carbon Collect. The first commercial-scale unit was installed on the Tempe campus in March 2022.

The Virginia G. Piper Charitable Trust awarded a \$5 million grant to the Kyl Center for Water Policy, the Morrison Institute for Public Policy and the Decision Center for a Desert City at the Julie Ann Wrigley Global Futures Laboratory to develop a comprehensive set of tools to measure Arizona's water supply. The Arizona CuRVE Project created the Arizona Colorado River Visualization Enterprise to visualize and map the water shortage in the Colorado River. Decision Theater is working with the Kyl Center to create dynamic visualizations that help people understand the impact of potential Colorado River scenarios. CuRVE will visualize in an accessible way the potential effects of Colorado River shortages for individual water systems, agricultural districts, tribal communities and industries across multiple years.

Bruce Rittmann's lab is nearly ready to spin out a new technology for removing PFAS from water. These harmful chemicals have been detected widely across drinking water sources.

Decision Theater has partnered with ASU's Healthy Urban Environments (HUE) to develop a map-based tool that assists local policymakers in identifying areas particularly vulnerable to heat and heat-based effects and to explore various intervention strategies.

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	2,768,412			2,768,412
Development	1,384,206			1,384,206
Total	4,152,618	0	0	4,152,618

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	40			40
Graduate Students	209			209
Undergraduate Students	136			136
Sponsored Project Funding	30,970,246			30,970,246
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	Collaborative Research Infrastructure and Core Facilities			
<b>Problem Statement:</b> As the state of Arizona positions itself to be a leader in the research areas targeted by TRIF, it is imperative that we maintain and enhance our core infrastructure that supports these initiatives. We have taken steps toward developing a statewide network to promote awareness of shared resources across the state. We have leveraged federal funding to the extent possible to secure advanced and highly specialized technologies. Just as important are our fundamental capabilities and personnel that form the backbone of our core infrastructure. TRIF funding is an essential component of our overall funding strategy to maintain an appropriate refresh rate of these broadly-impactful fundamental capabilities.				
<b>Program Description:</b> <b>Core Facilities mission:</b> To facilitate the expansion and enhancement of ASU's research enterprise by providing technical and scientific services to support faculty research objectives and enable success. <b>Strategy:</b> 1. Maintain state-of-the-art facilities and expert staff to support technologies and applications aligned with ASU's strategic research goals. 2. Provide effective access (physical, financial, training, workflows) and maintain customer-focused orientation. 3. Increase awareness of capabilities through marketing, communications and promotional efforts. 4. Engage industry and non-profit partners to fully leverage resources and maintain fiscal sustainability.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> ASU is uniquely poised to advance research and secure external funding in key areas that are enabled largely by core facilities. Given federal funding initiatives, our geographical location, and strength in advanced materials, solar, power electronics and other related areas, there is significant opportunity for expanding partnerships within the semiconductor industry as companies establish a presence in the Phoenix metro area. These will be supported by our NanoFab, Eyring Materials Center, Advanced Electronics and Photonics, and Solar Fab facilities. In addition to funding in the semiconductor space, ASU's strong clinical partnerships with multiple health care organizations provides a unique opportunity to competitively pursue National Institutes of Health funding through the Clinical and Translational Science Award program. Funding of infrastructure to provide shared clinical support services will be instrumental to advancing this effort.				
<b>Is there an Arizona Specific Benefit or Impact?</b> By nature, core facilities train a high volume of university students, staff and faculty, as well as industry partners, and thereby contribute significantly to hands-on workforce development. Many of our student trainees move on to work in local industry as scientists and engineers, utilizing the skill sets they develop under our training programs.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	1,000,000	1,000,000	1,000,000	3,000,000
Basic Research	670,128	670,128	670,128	2,010,383
Applied Research	670,128	670,128	670,128	2,010,383
Development	670,128	670,128	670,128	2,010,383
Total	3,010,383	3,010,383	3,010,383	9,031,149
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	159	167	175	501
Graduate Students	696	731	768	2,195
Undergraduate Students	332	349	366	1,047
Sponsored Project Funding	61,072,281	64,125,895	67,332,189	192,530,365
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	118,146	124,053	130,255	372,454
Startups	5	6	6	17
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University
TRIF Investment Area:	Water, Energy and Environmental Systems
Program Name:	Collaborative Research Infrastructure and Core Facilities

**2022 Progress Summary:**

Throughout FY 2022, ASU Core Research Facilities supported nearly 500 research projects and enabled expansion of fundamental capabilities and technologies that have been crucial to the success of 1,399 ASU faculty, student and staff researchers. Overall, we have trained 1,029 graduate and undergraduate students, providing opportunities to develop key skills in technologies that will help them succeed in Arizona's new economy.

For example, Aaron Flores is a first-generation college student who worked to put himself through community college before transferring to ASU. He was a student worker in the Metals, Environmental and Terrestrial Analytical Laboratory, one of ASU's core facilities, where he provided analyses for researchers across the university. He also conducted his own research and presented at two large professional conferences. Flores received his Bachelor of Science in chemistry in May 2022 along with the prestigious Dean's award. He received multiple job offers after graduation, selecting a position as an applications chemist with Elemental Scientific.

In addition, Core Research Facilities have supported 110 companies with a presence in Arizona.

One of these companies, Swift Coat, is an SBIR-awarded company that heavily uses ASU Core Facilities at the MacroTechnology Works site.

A company statement from Swift Coat noted: "In a given week, our engineers touch probably \$250,000 worth of core facilities equipment. These are things we may otherwise have to purchase or go without. Having access to a broad range of tools not only helps us to work faster and more effectively, but it helps to produce more compelling and complete grant proposals. In our SBIR application, for example, one of the reviewers asked if we were going to conduct a specific test as they felt it was important to the success of the project. We were able to identify the tools we needed to conduct that test/analysis in the core facilities catalog and respond that 'yes, we can add that to the scope of work and we have the capability to do it through ASU core facilities.' A lot of the instruments we use require experience to do so effectively. We don't always have that experience in staff and may not want (or have the time) to develop it ourselves. Fortunately, we're typically able to book a super-user through core facilities to run the equipment for us ensuring we get an accurate result the first time. I would say it's good for business development as well. When we have potential customers visit, we always take them on a tour of the relevant core facilities we use. When they see the resources we have access to, it gives them confidence that we'll be able to identify and solve their specific need."

**Investment Detail**

	2022	2023	2024	Total
Infrastructure	1,000,000			1,000,000
Basic Research	670,128			670,128
Applied Research	670,128			670,128
Development	670,128			670,128
Total	3,010,384	0	0	3,010,384

**Performance Measures**

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	139			139
Graduate Students	594			594
Undergraduate Students	274			274
Sponsored Project Funding	61,102,505			61,102,505
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	100,004			100,004
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	Skysong Innovations			
<b>Problem Statement:</b> ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.				
<b>Program Description:</b> SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). In 2020, ASU was issued 140 U.S. patents, tied with the University of Florida, up from 137 the previous year, and just one spot behind Harvard. Other U.S. universities in the top 10 include MIT, Stanford, and Caltech. Tsinghua University in Beijing was the only non-U.S. university to surpass ASU on the global list.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly \$1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and even take positions running these startups. In FY21, SI advanced sponsored research providing over \$30 million in funding for ASU, resolving IP and other substantive issues as part of the agreements.				
<b>Is there an Arizona Specific Benefit or Impact?</b> SI annually commissions the Seidman Research Institute to perform an economic impact analysis of ASU's tech transfer activities. The most recent report found that from 2016-2020, as a result of the operations of SI and the Arizona-based, ASU-linked companies, Arizona's economy gained a cumulative \$717.8 million in gross state product, \$477.9 million in labor income, 7,059 job years and \$64 million in state and local tax revenues. By 2025, Seidman projects the economic impact of SI and these ASU-linked companies will exceed \$2.3 billion, with the vast majority of that impact in Arizona.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	521,683	521,683	521,683	1,565,049
Applied Research	521,683	521,683	521,683	1,565,049
Development	521,683	521,683	521,683	1,565,049
Total	1,565,049	1,565,049	1,565,049	4,695,148
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	0	0	0	0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	5	5	5	15
Startup Investments	100,000,000	105,000,000	110,250,000	315,250,000
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	Skysong Innovations			
2022 Progress Summary:				
<p>In FY 2022, Skysong Innovations (SI) continued its trend as a highly productive, impactful technology transfer organization, capturing 305 new ASU innovations and securing 164 new U.S. patents. Additionally, SI closed 57 new licensing deals — not accounting for many other innovations licensed to industry partners in the context of research collaborations. Within these licensing activities, SI advanced the launch of 21 new startup companies founded upon ASU innovations ranging from new vaccines to safer battery technologies. Of the 21 new companies, 18 are based in Arizona. Notably, these output levels for innovations, patents, licensing deals and startups have historically placed ASU within the top 10 (and in some instances the top 5) among universities without medical schools, according to data published by the Association of University Technology Managers. ASU was one of only five such universities to rank in the top 10 across all four categories — along with Caltech, MIT, Purdue and North Carolina State.</p> <p>SI's productivity in FY 2022 focused on several innovations, patents, licensing deals and startups directed to water, energy and environmental systems. As one example, SI advanced the launch of new ASU startup Safe-Li. Safe-Li aims to commercialize a breakthrough ASU-developed technology that enables fire-safe lithium-ion and lithium-metal batteries. The technology, which arose from Jerry Lin's lab, also improves battery performance and longevity.</p> <p>FY 2022 also saw the creation of new ASU startup Optical Waters LLC, a company founded to advance ASU technologies created by Paul Westerhoff. Optical Waters aims to commercialize technologies for disinfecting water within otherwise hard-to-reach locations. The patent-pending technologies feature ultraviolet light-emitting optical fibers. The fibers can increase the area of ultraviolet light emission by 100 times compared to conventional ultraviolet disinfection techniques.</p> <p>In addition, in FY 2022 SI worked with Klaus Lackner and others at ASU's Center for Negative Carbon Emissions to capture 19 new innovations and secure two new patents directed to novel carbon-capture technologies. In partnership with industry, ASU aims to develop and deploy these technologies swiftly to maximize their impact on climate change. Because the ability to capture carbon from air at an affordable price would greatly enhance the options for developing the world's energy infrastructure, these technologies have significant potential.</p> <p>SI also worked with ASU researchers to advance numerous other environmental technologies along SI's technology transfer pathway. Such technologies ranged from multi-functional, reflective paints that combat the urban heat island effect (Ellie Fini's lab) to new plastics engineered for better recyclability (Kailong Jin's lab).</p> <p>In FY 2022, SI also continued to manage ongoing technology transfer activities related to a host of innovations, patents, licensing deals and startups that arose from ASU in prior years. By way of example, well-established ASU spinout SOURCE Global, PBC is a Phoenix-based certified public-benefit corporation commercializing the world's first renewable drinking water system. The SOURCE® Hydropanel is a sustainable off-grid water technology that uses the power of the sun to extract clean, reliable drinking water from the air. The</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research	521,683			521,683
Applied Research	521,683			521,683
Development	521,683			521,683
Total	1,565,049	0	0	1,565,049
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	0			0
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	5			5
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	MacroTechnology Works Site Development			
Problem Statement:				
<p>In developing a strategy for the MacroTechnology Works (MTW) site, we took on the mission "To become the engine of semiconductor and energy materials and device research in the US and a national resource for advancing new technologies to pilot scale." ASU has developed a model to realize this mission, leveraging the MTW site and the unique facilities and equipment available there to enable a collaborative university/startup/industry research model. Defining elements for this model include: strong core facilities for democratized research; small "proprietary" faculty and industry labs for unique toolsets; key corporate partners that enhance our capabilities and engage in joint research; a lease + user fees + research collaboration model that provides options that fit the scale of the partner; and <del>undergraduate, graduate, and employee training</del></p>				
Program Description:				
<p>The 5 major components of the program are: 1. Strong core facilities provide users with access to capital equipment within the core. This allows industry partners to access non-proprietary toolsets on a fee for service basis, and allows startups and smaller companies access to industry-scale tools. 2. The MTW site has highly configurable space within cleanroom environments that allow small proprietary lab spaces to operate on site. These labs are available as leased spaces for industry partners and are required to also commit to funding research activities. 3. Key corporate partners provide opportunities to enhance access to state of the art tools for materials deposition, etch, and characterization and provide opportunities for industry relevant research activities. 4. Engaging with companies at various scales is enabled via a scalable model that engages partners in leased space, core facilities usage, and research collaboration that provides a win-win opportunity for ASU researchers to participate in value added research that aligns with industry needs. 5. Undergraduate, grad student, and post doc participation in research projects and training on industry relevant tools helps to prepare the <del>next generation semiconductor workforce</del></p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>With recent announcements of new semiconductor fabs being built in the valley, Arizona has an opportunity to become the hub of semiconductor research and innovation in the U.S. ASU has a robust pipeline of semiconductor research and has key partnerships in place to expand the ecosystem in Arizona. ASU researchers engaged in programs at MTW are currently funded at ~\$25 million per year, and we expect federal and industry funding for semiconductors to grow. Our projections are amplified by the federal requests for funding via the CHIPS act which addresses supply chain shortages in the wake of the COVID pandemic. ASU is expecting to participate in a number of large scale opportunities related to manufacturing and supply chain working with Arizona industry partners including a NIST-sponsored Manufacturing USA Institute and a DOD-sponsored National Network for Microelectronics Research and Development.</p>				
Is there an Arizona Specific Benefit or Impact?				
<p>There are several impacts to Arizona. Research activities at ASU can be tied directly in intellectual property (IP) generation and oftentimes to startup companies, jobs and wealth creation. ASU is engaged with eight Arizona-based startups at MTW already. Student engagement in research opportunities provides experiential learning and results in better trained employees. With recent announcements of new fab facility construction in the state there is a heavy demand for employees in the semiconductor industry, well beyond the needs within the fabs as suppliers across the supply chain also increase staffing.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	0	0	0	0
Development	1,000,000	1,000,000	1,000,000	3,000,000
Total	1,000,000	1,000,000	1,000,000	3,000,000
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	5	5	5	15
Graduate Students	20	20	20	60
Undergraduate Students	0	0	0	0
Sponsored Project Funding	30,000,000	33,000,000	37,000,000	100,000,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	9	11	12	32
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	MacroTechnology Works Site Development			
2022 Progress Summary:				
<p>Our mission at MacroTechnology Works (MTW) is to become the engine of semiconductor and energy materials and device research in the U.S. and a national resource for advancing new technologies to pilot scale. This goal is built upon leveraging our site and its unique facilities and equipment available to enable an university-startup-industry collaborative research model.</p> <p>In FY 2022, we made strides toward that goal, with a major uptick in activities at MTW. This is in part due to easing of COVID restrictions as well as the increase in semiconductor industry activities in Phoenix following announcements from TSMC and Intel to construct new fabrication facilities in Arizona — a \$32 billion investment. The state-funded New Economy Initiative (NEI) also increased activity at MTW by funding five Science and Technology Centers (STC). The STC for Advanced Materials Processes and Energy Devices funded toolsets for advanced materials, solar power and battery research at MTW.</p> <p>The MTW site hosts two ASU Core Facilities: the Solar Fab (SF) and Advanced Electronics and Photonics (AEP). Core Facilities provide access to toolsets on a fee-for-service basis for both ASU and external users. The AEP receives direct TRIF funding and metrics from the AEP are included below. The Solar Fab indirectly receives funding as users of the SF are eligible for TRIF-funded transportation programs. In fiscal year 2022, AEP core external sales increased 80% overall with total revenue of \$289,145, including \$238,919 of external sales and \$50,226 of internal sales.</p> <p>In FY 2022, we expanded and improved MTW's toolset using NEI STC funding. NEI funds were utilized to procure materials processing and characterization tools including 300mm Etch, 300mm Maskless Photolithography, and 200mm and 300mm Atomic Layer Deposition, as well as upgrades to existing MOCVD, tube and belt furnaces, and characterization tools. A pouch cell battery pilot line was also procured, along with a dry lab facility and battery characterization tools.</p> <p>The MTW site also hosts proprietary lab spaces, which remained fairly level this year. We host three medium- to large-scale enterprises and nine small enterprises, and increase from eight last year. ASU is currently undergoing a number of lab renovations, which will make additional space available in coming years, including additional faculty labs. In addition to proprietary labs on site, there were 23 total external users of the AEP core facilities, including 13 startups, eight medium to large enterprises and two universities.</p> <p>All of these renovations and equipment purchases position ASU for success in the NEI and anticipated microelectronics bids.</p> <p>Student engagement at MTW is measured in two different ways. First, usership of AEP, which hosts 21 different faculty labs and 44 users including seven undergraduate students, 19 graduate students, five post-doctoral scholars and 13 faculty and staff members. The second measure is Lyft ridership between the Tempe campus and MTW. Lyft ridership is available for faculty and staff that work between MTW and Tempe campus to facilitate access to the MTW site, which is located approximately eight miles away from campus at the ASU Research Park. In FY 2022 there were 30 Lyft riders for a total of 1,121 rides to the MTW site. This is up from 14 riders and 385 rides in FY 2021.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research				0
Development	1,001,818			1,001,818
Total	1,001,818	0	0	1,001,818
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	18			18
Graduate Students	217			217
Undergraduate Students	28			28
Sponsored Project Funding	17,406,135			17,406,135
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	11,250			11,250
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	Research Development			
<b>Problem Statement:</b> Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.				
<b>Program Description:</b> Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.				
<b>Is there an Arizona Specific Benefit or Impact?</b> ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	201,189	201,189	201,189	603,566
Applied Research	201,189	201,189	201,189	603,566
Development	201,189	201,189	201,189	603,566
Total	603,566	603,566	603,566	1,810,698
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	40,000,000	42,000,000	44,100,000	126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University
TRIF Investment Area:	Water, Energy and Environmental Systems
Program Name:	Research Development

**2022 Progress Summary:**

Research Development (RD) hosted 39 events during FY 2022 across four categories with 977 in-person attendees. We reached 386 faculty in FY 2022, 54 more than in FY 2021. Research Development supported 20 full proposals and 14 preliminary proposals in FY 2022, with an overall potential total value of \$687 million. We provided graphic support to 23 proposals, worth a potential value of \$557 million. Strategic intelligence provides analysis to inform strategic decision-making by ASU leaders. In FY 2022, they produced 81 documents overall, with the majority of these being program analyses (26). Program analyses focus on specific funding opportunities that are of high interest to the ASU community. The analysis provides background (past award history) and foreground (capacity at ASU) to increase the competitive nature of proposals designed by ASU investigators. In addition, they produced 18 capacity analyses, which are designed to identify intellectual capacity at the university so that it can be harnessed to pursue large and strategic initiatives. RD disseminated 219 funding opportunities across multiple sponsors. Our internal review program was used for 13 highly competitive opportunities. The transparent, equitable review of applications results in increasing the positioning of subsequent applications to the sponsor agency. This year, the program was able to coordinate 50 faculty and provide robust, timely feedback to all applicants. Note: sponsored funding listed in the metrics are proposals not awards.

**Water, Energy and Environmental Systems highlights**

- RD supported a \$400 million concept note and application to the USAID Water and Development Indefinite Delivery Indefinite Quantity Contract opportunity.
- RD supported six proposals to the Department of Energy worth a potential value of \$46 million.

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research	263,058			263,058
Applied Research	263,058			263,058
Development	263,058			263,058
Total	789,174	0	0	789,174

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	487,025,000			487,025,000
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	Center for Bio-mediated and Bio-Inspired Geotechnics (CBBG)			
<b>Problem Statement:</b> Through the Center for Bio-mediated and Bio-Inspired Geotechnics (CBBG), Arizona State University is the international leader in applying the emerging field of biogeotechnics to develop sustainable and resilient geotechnical solutions for civil infrastructure systems. Through direct application of and by mimicking biological processes abiotically, CBBG seeks to reduce the life cycle costs and environmental and social impacts of construction, operation, and maintenance of infrastructure systems that build on, in, and with earthen materials.				
<b>Program Description:</b> Led by ASU, CBBG is a National Science Foundation Gen-3 Engineering Research Center and includes three other leading public Universities: Georgia Institute of Technology, New Mexico State University and the University of California at Davis. CBBG has four technological thrusts: Geological Hazard Mitigation; Environmental Protection and Ecological Restoration; Infrastructure Construction Methods and Materials; and Subsurface Exploration and Excavation. CBBG also has a focus on Innovation, Diversity and Inclusion, and Education that includes a robust K-12 outreach program and a Research Experience for Teachers (K-14) program that has a strong emphasis on participants from underrepresented groups.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> ASU is uniquely suited to lead CBBG because of its emphasis on transdisciplinary and use-inspired research, sustainable development, local impact and social embeddedness, and global outreach. With its focus on bio-mediation, bio-inspiration and earthen (geologic) materials, CBBG research is by nature a transdisciplinary endeavor. Its progress is facilitated by ASU's ability to foster and support interdisciplinary work. All CBBG projects must be targeted towards sustainable development of civil infrastructure, i.e., must be use-inspired, whether it be focused on fundamental knowledge development or integration of a new technology into civil infrastructure systems. And all CBBG projects must be supported by a life cycle sustainability assessment (LCSA) that documents potential contributions of the project to the triple bottom line of social, environmental and financial benefit.				
<b>Is there an Arizona Specific Benefit or Impact?</b> TRIF support for CBBG has many direct and indirect benefits for Arizona. Direct benefits include research on problems of major importance to the health and well-being of Arizona citizens such as fugitive dust control and remediation of groundwater impacted by chlorinated solvents, education and training for Arizona's engineering workforce, training and curriculum development for local K-14 schools, and entrepreneurial opportunities for startup businesses. Indirect benefits for Arizona not only include contributions to sustainability and resilience of civil infrastructure systems across the U.S. and worldwide but also research on global problems of concern to major Arizona-based industries such as mitigation of the impacts of mining on groundwater and enhanced management of methane emissions at landfills.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	400,000	400,000	400,000	1,200,000
Basic Research				0
Applied Research				0
Development				0
Total	400,000	400,000	400,000	1,200,000
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	4	4	4	12
Graduate Students	19	20	21	60
Undergraduate Students	12	12	13	37
Sponsored Project Funding	2,205,548	2,315,826	2,431,617	6,952,991
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

### 2022 Progress Summary:

In FY 2022, the Center for Bio-mediated and Bio-inspired Geotechnics (CBBG) worked to strengthen and forge new industry partnerships, continue education and outreach, develop new research technologies and plan for the future.

In particular, TRIF funds supported and enhanced our industry partnership program, initiated strategic planning for operation of CBBG after the end of the National Science Foundation core-funding period, supplemented funding for our education and outreach program, and supported development of a large-scale rainfall simulator for research on soil erosion.

TRIF funds were used to support CBBG industry liaison officer (ILO) efforts to solicit research funding from industry partners, maintain the membership of existing industry partners, and recruit additional industry partners. These efforts resulted in funding in excess of \$200,000 for CBBG projects from two current industry partners and exploratory conversations with a potential new partner. The ILO also successfully recruited two new industry partners to replace two outgoing partners, resulting in steady industry membership.

The ILO and CBBG leadership worked together to develop a collaborative relationship with the Cosanti Foundation, an Arizona not-for-profit corporation that owns and operates Arcosanti, an "urban laboratory" in Yavapai County. This relationship created an opportunity for CBBG students to conduct research and development at the Arcosanti site, culminating in an "Arcosanti Design Challenge" at the CBBG mid-year meeting.

After July 2025, CBBG will no longer be eligible for National Science Foundation core funding. To ensure CBBG operations after this period, leadership and the ILO worked with our partners, the CBBG Science Advisory Board, and government agencies such as Arizona Department of Environmental Quality and Federal Highway Administration to develop a strategic framework for the future. Integral to this strategic plan is identifying funding sources to develop use-inspired CBBG research that can address problems critical to Arizona and our region, including fugitive dust suppression and abandoned mine remediation.

CBBG's education and outreach activities continued to develop in FY 2022. TRIF funding supported the development of a suite of continuing education courses for industry with a two-fold aim: supporting industry partners and creating a revenue stream from non-partner industry. TRIF funding was also used for the CBBG Young Scholar program, which supported two promising Arizona high school students to gain hands-on experience and education in the CBBG laboratories over the summer.

Finally, CBBG used TRIF funds to complete the large-scale rainfall simulator at our field laboratory on the Polytechnic campus. This simulator is one of only three that meets American Society of Testing Materials standards and has the potential to attract a significant amount of sponsored research.

### Investment Detail

	2022	2023	2024	Total
Infrastructure	195,572			195,572
Basic Research				0
Applied Research				0
Development				0
Total	195,572	0	0	195,572

### Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	2			2
Graduate Students	20			20
Undergraduate Students	17			17
Sponsored Project Funding	4,410,534			4,410,534
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Water, Energy and Environmental Systems			
Program Name:	NSF Nanosystems Engineering Research Center for Off-Grid Nanotechnology Enabled Water Treatment (NEW)			
Problem Statement:	<p>The vision of the Nanosystems Engineering Research Center for Nanotechnology-Enabled Water Treatment Systems (NEWT) is to enable access to water of suitable quality almost anywhere in the world by developing next-generation, easy-to-deploy modular treatment systems enabled by nanotechnology. These efforts both protect human lives and support sustainable economic development.</p>			
Program Description:	<p>NEWT aims to develop new technologies to purify drinking and industrial waters. Initially funded in 2015, we are renewed through 2025. As NEWT approaches self-sufficiency, we are request funding to continue discovery of new treatment technologies that will stimulate the many industrial partners with breakthrough science. This compliments our strong success in industrial members then funding associated projects. Personnel time and material funds will be used to support multiple NEWT faculty on high-risk science that will collect preliminary data for new extramural funding proposals, and funds to demonstrate technology translation using our mobile testbed. The NEWT faculty and student team has been amazingly successful with new patents, start-ups and STTR awards – and having the ability to translate to the testbed has proven essential in these higher TRL endeavors. The NEWT team leads and participates in a broad range of outreach, education and diversity activities.</p>			
What is the University's Advantage and/or Anticipated Funding Opportunities?	<p>ASU has lead recruitment and collaboration with over 25 industrial members of NEWT. Annually these industrial members fund an additional \$1 million at ASU in research through NEWT. The NEWT research has been leveraged to be part of a recent NIH MEMCARE Center with Harvard and Yale, and a new NSF Science and Technology Center to be launched in October 2021. Within NEWT we are on the verge of a new project with the Gates Foundation for reuse of greywater inside homes, and use of the reused water for sanitation. This is considered a high-risk, high-tech solution that Gates is providing to NEWT and considerable follow-on funding and industrial spinouts are expected.</p>			
Is there an Arizona Specific Benefit or Impact?	<p>NEWT is recruiting more Arizona-based industry partners struggling with on-site water reuse challenges that they must address to meet corporate sustainability goals. This both improves water conservation efforts in our desert state and increases the visibility of ASU researchers to the private sector as experts who can rapidly solve real-world problems and provide actionable information for companies. Two start-up companies in Arizona related to NEWT technology have advanced funding from NASA and hire employees in Arizona. In addition to working with industry, our technologies are being integrated into water solutions for rural communities to provide clean drinking water. Annually we bring undergraduates from Arizona Community colleges and high school teachers from Arizona into our research labs.</p>			
Investment Detail	2022	2023	2024	Total
Infrastructure	35,000	35,000	35,000	105,000
Basic Research				0
Applied Research				0
Development				0
Total	35,000	35,000	35,000	105,000
Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	4	4	4	12
Graduate Students	19	20	21	60
Undergraduate Students	12	12	13	37
Sponsored Project Funding	2,205,548	2,315,826	2,431,617	6,952,991
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University
TRIF Investment Area:	Water, Energy and Environmental Systems
Program Name:	NSF Nanosystems Engineering Research Center for Off-Grid Nanotechnology Enabled Water Treatment (NEW)

**2022 Progress Summary:**

Nanosystems Engineering Research Center for Nanotechnology-Enabled Water Treatment Systems (NEWT) continues to move toward self-sufficiency by securing government awards and industry funding and applying for patents.

NEWT recently disclosed and expanded a patent application related to our technology that can to degrade pollutants in water. The technology uses hydrogen delivered from very small porous membrane fibers coated with bimetallic catalysis that facilitate the chemical destruction of nitrate and per- and poly-fluoroalkyl substances (PFAS). This technology is poised to benefit Arizona, as both nitrate and PFAS occur in many groundwaters in our state and pose health risks in drinking water.

This advancement was made possible through at least three years of research funded by NEWT, with another two years of funds committed to support students and educational materials. Industry partner Xylem has also provided approximately \$250,000 to advance this technology beyond the lab. The Department of Defense funded an additional \$95,000 to obtain proof of concept demonstration for PFAS destruction, and will likely provide additional funding for techno-economic development and feasibility testing.

TRIF funding, along with additional funds from NEWT, will be used to procure a pilot-scale system to identify and overcome scaling issues as well as demonstrate the technical and economic viability of this nitrate and PFAS-eliminating technology.

Based upon early NEWT support, NASA has funded two separate biofilm mitigation technologies. One uses silver nanoparticles attached to surfaces via novel coating methods. A second approach uses side-emitting flexible optical fibers to deliver germicidal ultraviolet light into piping or tubing. These technologies are based upon ASU intellectual property, involve two Arizona start-up companies — Cactus Materials and H2Optic Insights — and have brought more than \$1.25 million to ASU.

In addition, NEWT has begun designing a novel greywater chemical removal and disinfection system for the Gates Foundation. Demonstrating electrochlorine generation in wastewater, this project may lead to the reuse of greywater in residential and sanitation settings, greatly expanding water conservation.

**Investment Detail**

	2022	2023	2024	Total
Infrastructure	35,000			35,000
Basic Research				0
Applied Research				0
Development				0
<b>Total</b>	<b>35,000</b>	<b>0</b>	<b>0</b>	<b>35,000</b>

**Performance Measures**

	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	7			7
Graduate Students	25			25
Undergraduate Students	12			12
Sponsored Project Funding	1,461,643			1,461,643
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Space Exploration and Optical Sciences			
Program Name:	Interplanetary Initiative			
<b>Problem Statement:</b> Humankind is compelled to explore space and will have a space future. Most efforts to prepare for this space future are aimed toward incremental science in narrow disciplines. They struggle to cope with the larger picture or, alternatively, only look at the larger societal impacts without being connected to real scientific endeavors. However, humankind's space future requires fusing disciplines together for these efforts to succeed.				
<b>Program Description:</b> The interplanetary Initiative is transforming both how we educate the next generation and how we fundamentally conduct research while finding common cause in an essential challenge for humanity: our space future. Space exploration is a compelling, freeing vehicle for ideation about the future of society and education. To build a positive space future, people will need to embrace and know how to tackle unsolved problems. ASU is uniquely prepared to create thoughtful, communicative, transdisciplinary teams including scientists, engineers, psychologists, sociologists, artists, public relations experts, historians and beyond. The interplanetary Initiative is creating and implementing novel pan-university learning programs centered on open inquiry and launching new research driven by interdisciplinary teams tackling some of the biggest questions about space exploration. The implementation and scaling of our unique teaming and learning processes will make problem-solving and knowledge creation accessible to all of society.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> The Interplanetary Initiative helps ASU drive forward (and ultimately scale) new models of learning and research that support an inclusive and sustainable space future. The program also explores new organizational models for advancing ASU's mission. The initiative's experimental processes and programs, in addition to the interdisciplinary and cross-sector community of thought leaders which it has nurtured and grown, puts ASU in a competitive position for high-impact partnerships and funding opportunities in the space sector, such as its partnership with XPRIZE.				
<b>Is there an Arizona Specific Benefit or Impact?</b> The initiative's novel learning programs, such as its Technological Leadership B.S. and the OpenCitizen program, will directly benefit learners and businesses based in Arizona. For example, OpenCitizen meets learners wherever they are — in the home or the workplace — and connects their learning experience to what matters most to them in their communities. OpenCitizen's local problem solving focus benefits Arizona by empowering its citizens to make positive changes in their community while gaining new skills. The Technological Leadership B.S., which has just completed its first year and offers a radically different learning experience in which students direct their own learning through research processes, enrolled 18 students living in Arizona.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	133,333	133,333	133,333	400,000
Applied Research	133,333	133,333	133,333	400,000
Development	133,333	133,333	133,333	400,000
Total	400,000	400,000	400,000	1,200,000
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	2	2	2	6
Graduate Students	6	6	6	18
Undergraduate Students	64	67	71	202
Sponsored Project Funding	5,089,714	5,344,200	5,611,410	16,045,324
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**  
 The Interplanetary Initiative’s networked model catalyzes external partnerships, external funding and educational/workforce development programs working with ASU faculty, students and staff across the entire university.

**Interdisciplinary, cross-sector projects**

Cumulatively, our portfolio includes 44 projects, including research pilots, lab projects and other types of collaborative efforts. Our cumulative pilot project seed investment of \$1 million has generated \$8.1 million in external funding via grants, contracts and royalties. In FY 2022, we supported five research pilots, one of which secured an \$850,000 NSF grant. Another project we supported this year focused on novel governance and financial models for integrating space in the local Arizona economy. We are seeding eight new cross-sector research pilots in FY 2023 with collaborators from organizations including NASA, Lockheed Martin, The Aerospace Corporation, U.S. Space Force, XPRIZE Foundation, Maxar Corporation, The Planetary Society and the Harvard Smithsonian Institution. These projects aim at big questions such as “How do we build a just, equitable, diverse, and inclusive space for all of humanity?” and “How do we reduce the probability of a cataclysmic space war by redefining the way that space is understood and by laying the foundations for an innovative, interdisciplinary commitment to preserving space as a collaborative domain free from war?” The Interplanetary Lab has been established as the latest core facility at ASU, serving the needs of faculty, students and companies. The lab is developing four hardware projects and has supported several local Arizona industry partners through services and grant application support.

**Innovative educational and workforce development programs**

As of the end of the spring 2022 semester, 62 students were enrolled in our Technological Leadership degree program, which launched in fall 2021. This is a 32% increase over the same period in 2021. Our first two students graduated this year. In fall 2022, we will launch a new minor in Technological Leadership. We successfully launched the OpenCitizen program in partnership with Beagle Learning and the Learning Enterprise with an event called “The Gathering,” which attracted 75 attendees across 24 organizations. OpenCitizen offers an expert-created process for learning and problem-solving that helps people achieve a goal of their choice — and earn college credit along the way. Approximately 200 students have come through the Interplanetary Lab to work on projects since January 2022. We have also trained nine undergraduate and graduate student “lifeguards” to date to provide services and run projects in the lab. Our first-to-graduate student “lifeguard,” Matthew Adkins, secured a job at Blue Origin working on projects that include the Orbital Reef space station.

**Public engagement, partnerships and thought leadership**

Our marquis event, the Annual Space Futures Convening, was hosted in Phoenix and brought together 50 thought leaders from industry, government and academia across 30 organizations. ASU, through the Interplanetary Initiative, is one of six partners on the Orbital Reef project — a next-generation commercial space station in low-earth orbit that secured \$130 million in NASA funding. A four-year, \$400,000 contract from Blue Origin establishes ASU as the lead organizer of the advisory council of 15 universities who all have extensive experience and expertise in space exploration, microgravity research and human performance in space. We secured a small donation from an Arizona-based investor supporting the launch of a global prize to encourage more CubeSat missions that advance

Investment Detail	2022	2023	2024	Total
Infrastructure				0
Basic Research	133,272			133,272
Applied Research	133,272			133,272
Development	133,272			133,272
<b>Total</b>	<b>399,816</b>	<b>0</b>	<b>0</b>	<b>399,816</b>

Performance Measures	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	1			1
Graduate Students	4			4
Undergraduate Students	18			18
Sponsored Project Funding	5,522,827			5,522,827
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Space Exploration and Optical Systems			
Program Name:	Space Technology and Science Initiative (NewSpace)			
Problem Statement:				
<p>Morgan Stanley predicts that by 2040, the space economy will be over \$1 trillion. The exponential growth in the commercial space industry provides an enormous opportunity for universities to partner with commercial space companies. ASU's expertise in space science and technology and a growing commercial space industry presence provide multiple entry points for partners to engage and see mutual benefits. NewSpace works across the university on numerous commercial space projects, including satellite communication and ground stations, DOD space opportunities, continued growth in NASA funding, development of a spaceport in Arizona, space industry presence on campus, commercial remote sensing projects for Arizona, and ASU exposure at industry events.</p>				
Program Description:				
<p>The ASU Space Technology and Science ("NewSpace") Initiative was established in 2013. The Initiative was designed to develop and integrate the commercial space industry with the space science and technology community at ASU. Leveraging heritage experts from ASU for space and space relevant science and technology growth, we have been successful in securing a number of new space-related projects on campus, including a NASA-funded deep space satellite mission to orbit the Moon for mapping of lunar polar hydrogen and other programs focused on space-related sensors, instruments and spacecraft systems. ASU NewSpace is supporting the growth of the Arizona space industry through ASU student capstone programs, the establishment of a space business entrepreneurship course for students, and partnerships with industry to enable access to the unique space-relevant facilities available on campus. We also focus on developing an ASU-led satellite communication and tracking ground station, smallsat instrument development and technology advancement, industry sponsored senior design/capstone course growth, and Arizona NASA Space Grant mentorship.</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>ASU has over 300 investigators that submit proposals to NASA and other space-related funding sources. Leveraging and growing this space researcher cohort has been a focus at ASU NewSpace. Incorporating our 400+ industry partners into funding proposal development, we directly enabled the submission of over \$60 million in proposals to federally sponsored opportunities in FY21, leading to over \$1.5 million in awards last year. We forecast that through ASU NewSpace there will continue to be growth in proposals annually of \$40-\$75 million, along with an increase in our win rate on awards.</p>				
Is there an Arizona Specific Benefit or Impact?				
<p>Yes. ASU NewSpace has cultivated relationships with more than 60 Arizona-based companies or institutions in the space industry. These industry relationships have resulted in multiple sub-contracts to NASA-funded projects, multiple ASU senior design/capstone projects and multiple public-facing events through organizations like AZ Commerce Authority, the City of Tempe, the Greater Phoenix Economic Council, AZ Tech Council and others. These benefits and impact will continue to grow as ASU NewSpace expands its ability to assemble ASU experts and commercial space industry partners to pursue new funding opportunities. These efforts will enable deep relationships to benefit the students, faculty and facilities at ASU along with the growing Arizona space industry.</p>				
Investment Detail (in tens of thousands of dollars)				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	0	0	0	0
Applied Research	200,000	200,000	200,000	600,000
Development	200,000	200,000	200,000	600,000
Total	400,000	400,000	400,000	1,200,000
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	1	1
Graduate Students	6	9	12	27
Undergraduate Students	40	42	44	126
Sponsored Project Funding	1,500,000	2,500,000	4,000,000	8,000,000
Publications in Academic Peer-Reviewed Journals	1	1	2	4
License and Options Income	0	0	0	0
Startups	0	0	1	1
Startup Investments	0	0	50,000	50,000
Startup FTEs	0	0	2	2

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Space Exploration and Optical Systems			
Program Name:	Space Technology and Science Initiative (NewSpace)			
2022 Progress Summary:				
<p>The efforts of the NewSpace Initiative to create connections between commercial space industry and the space science community at ASU continues to reach new heights. In FY 2022, NewSpace directly supported \$14.3 million in proposal submissions with 14 different ASU faculty principal investigators, yielding \$2.7 million in awards. Award exemplars include:</p> <ul style="list-style-type: none"> <li>• Craig Hardgrove’s NASA/SIMPLEX “Lunar Polar Hydrogen Mapper” satellite mission (LunaH-Map) with support from Arizona commercial space companies Qwaltec, KinetX and AZ Space Technologies. This award will continue through FY 2024 on NASA’s Artemis-1 launch and mission with support from these local industry partners.</li> <li>• ASU Luminosity Lab’s NASA’s Big Ideas Challenge project titled “Charlotte – Crater Hydrogen and Regolith Laboratory for Operation on Technical Terrain Environments.” Supported by advice and feedback from NewSpace, this student-led program leverages multiple lunar simulation sites across Tempe and Arizona to mature this future lunar robotic rover.</li> <li>• Sean Bryan’s “CubeSounder” instrument completed two technology maturation flights with Worldview, a high-altitude balloon company based in Tucson. Worldview launched Bryan’s atmospheric water imaging instrument to the stratosphere to test and operate the instrument in a space-relevant environment.</li> <li>• Christian Hoover received a NASA award to support the University of Arizona’s OSIRIS-REx mission asteroid sample analysis. Without NewSpace’s leadership and development of the relationships for integrating commercial space industry to ASU, these awards would have not materialized.</li> </ul> <p>NewSpace also collaborated with the Arizona Commerce Authority on a proposal to the Small Business Administration and subsequent Federal and State Technology (FaST) Partnership Program award. The resulting \$125,000 award is to increase SBIR/STTR submittals from small businesses in Arizona. The FaST program provides microgrants to increase SBIR/STTR wins. NewSpace supports the award as a hub for aerospace expertise and gateway into core facilities and labs on campus. Additionally, NewSpace participated in a virtual session with NASA, AZ Tech Council, Maricopa County Small Business Development Center, and Phoenix Analysis and Design Technologies with 25 virtual attendees to discuss the NASA SBIR/STTR program and where proposers can find support across the state and at ASU.</p> <p>NewSpace was an exhibitor at the ASU Day at the Capitol to provide informative insights to the public, legislators and staff. We partnered with Sean Bryan and Worldview to promote the Arizona-centric NASA flight opportunity program CubeSounder. We presented the program and results to members of the public along with 20 members of the state legislature and their staff.</p> <p>NewSpace is a participating Advisory Board member of the Arizona NASA Space Grant for ASU. We are also the only academic institution members of the Executive Board of the nationwide Commercial Spaceflight Federation, based in Washington, D.C. Through these board positions, as well as our newsletter and social media outreach, we have reviewed applications and promoted faculty, staff and student research and internship opportunities annually to the local community. For FY 2023, we are working with local aerospace companies, the Commercial Spaceflight Federation, and other national and international organizations to expand opportunities on</p>				
Investment Detail (in tens of thousands of dollars)				
	2022	2023	2024	Total
Infrastructure				0
Basic Research				0
Applied Research	200,101			200,101
Development	200,101			200,101
Total	400,202	0	0	400,202
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	8			8
Undergraduate Students	48			48
Sponsored Project Funding	1,211,333			1,211,333
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Space Exploration and Optical Sciences			
Program Name:	Materials of the Universe			
Problem Statement:				
<p>Space exploration is now pursued actively in both the private and government sectors. The discovery of complexities in our solar system and of thousands of remarkably diverse exoplanets raises both fundamental and practical questions. To understand planets, we need to combine knowledge from fields ranging from astrophysics to geochemistry to materials science. We need to answer materials-based questions, such as determining the detailed structure, composition and evolution of distant planets based on a few observed properties. At the same time, we need better materials for space exploration — solving problems like finding more sensitive spectroscopic detectors, building more robust space vehicles, and extracting and utilizing extraterrestrial resources.</p>				
Program Description:				
<p>The Navrotsky Eyring Center for Materials of the Universe (MotU) addresses the two challenges above — understanding planets and improving materials for space exploration — by an interdisciplinary program involving about 20 faculty from the School of Molecular Sciences (SMS), the School of Earth and Space Exploration (SESE) the Department of Physics, and the School for Engineering of Matter, Transport, and Energy (SEMTE). A major thermodynamics and high-temperature materials laboratory has been established by the MotU director, Alexandra Navrotsky, who joined ASU in 2019, and further strengthened by the hire of Professor Hongwu Xu, arriving this fall. Four additional MotU faculty positions are planned in the College of Arts and Sciences, with two searches commencing imminently. A major NSF proposal for a high-pressure center has been submitted, thus adding emphasis to materials under extreme conditions relevant to planetary systems — high temperature, high pressure, radiation fields, etc. Faculty in different fields are co-supervising graduate students. Seminars, courses and workshops have been held and are being developed.</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>ASU has unique strengths in astrophysics, planetary exploration (both orbiters and landers), experimental geochemistry and thermodynamics, electron microscopy and fundamental theory, with a distinguished history of collaboration in solid state science. There are funding opportunities from NSF, DOE, NASA and DOD, and a number of proposals have already been submitted and some funded. A large private gift to support MotU, partly now and partly as a bequest, has been finalized.</p>				
Is there an Arizona Specific Benefit or Impact?				
<p>With growing high tech and space related industries in Arizona, MotU will have increasing opportunities for collaboration with industry. The growing industrial sector will have access to ASU facilities and uniquely trained students who will function at the interface of space science, physical science and engineering.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	106,667	106,667	106,667	320,000
Applied Research	106,667	106,667	106,667	320,000
Development	106,667	106,667	106,667	320,000
Total	320,000	320,000	320,000	960,000
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	2	2	2	6
Graduate Students	2	2	2	6
Undergraduate Students	0	0	0	0
Sponsored Project Funding	381,034	400,085	420,090	1,201,209
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

University:	Arizona State University			
TRIF Investment Area:	Space Exploration and Optical Sciences			
Program Name:	Materials of the Universe			
2022 Progress Summary:				
<p>The Navrotsky Eyring Center for Materials of the Universe (MotU) is proud to report a number of important achievements in FY 2022. Our biggest success is the establishment of FORCE, the Facility for Open Research in a Compressed Environment. This new research center at ASU focuses on high-pressure research using unique multi-anvil presses and provides research capabilities to both the ASU and external communities. FORCE is funded by a five-year, \$13.7 million implementation grant from the NSF Mid-scale Instrumentation Program. The new FORCE facility will enable principal investigator Kurt Leinenweber and co-PIs Alexandra Navrotsky, Thomas Sharp, David Smith and Dan Shim to drive transformation and innovation in high-pressure science and lead a research center unique in the U.S., serving investigators at ASU, nationwide and worldwide. A research scientist with extensive multi-anvil press research, Kyusei Tsuno, has been recruited to start in August 2022, and another staff scientist, Kara Brugman, will join FORCE in January 2023. FORCE and MotU, though distinct entities, work closely together.</p> <p>Additional new recruits include Hongwu Xu from Los Alamos National Laboratory, who joined the School of Molecular Sciences faculty as a MotU hire in January 2022, and Jie Xu, who will be joining in August 2022. Other faculty recruitments are underway.</p> <p>MotU faculty have collaborated on a number of large interdisciplinary research proposals. Navrotsky has received several grants (renewals and new) for the thermochemistry efforts in MotU. MotU faculty have also published over 100 scientific papers and made many presentations at meetings, both virtual and, increasingly, in person. Navrotsky's special topics course (Chem 501c, Current Topics in Geo and Environmental Chemistry) attracted 16 students from diverse graduate programs in spring 2022. Its focus, with both internal and external speakers, was materials under extreme conditions, especially high pressure.</p> <p>Professor Navrotsky has given a bequest to ASU of the order of \$10 million to support research in materials. As part of these efforts, two ASU professors have recently been appointed the first-ever Navrotsky Professors of Materials Research. Candace Chan, an associate professor in the School for Engineering of Matter, Transport and Energy, and Dan (Sang-Heon) Shim, a professor in the School of Earth and Space Exploration, were selected based on their significant contributions in the field of materials research. Through the Navrotsky Professorship, Chan and Shim will serve to build the field of solid state science and materials research at ASU. The funding they receive will also enable them lead efforts to create new materials innovation and research collaborations across the Department of Physics, the School of Molecular Sciences, the School of Earth and Space Exploration, and the School for Engineering of Matter, Transport and Energy.</p>				
Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research	70,794			70,794
Applied Research	70,794			70,794
Development	70,794			70,794
Total	212,382	0	0	212,382
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	6			6
Graduate Students	5			5
Undergraduate Students	2			2
Sponsored Project Funding	444,000			444,000
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Arizona State University			
TRIF Investment Area:	Space Exploration and Optical Sciences			
Program Name:	Research Development			
<b>Problem Statement:</b> Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.				
<b>Program Description:</b> Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.				
<b>Is there an Arizona Specific Benefit or Impact?</b> ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.				
<b>Investment Detail</b>				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	22,989	22,989	22,989	68,967
Applied Research	22,989	22,989	22,989	68,967
Development	22,989	22,989	22,989	68,967
Total	68,967	68,967	68,967	206,902
<b>Performance Measures</b>				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	40,000,000	42,000,000	44,100,000	126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
License and Options Income	0	0	0	0
Startups	0	0	0	0
Startup Investments	0	0	0	0
Startup FTEs	0	0	0	0

# Arizona Board of Regents

## Technology and Research Innovation Fund (TRIF) Program Progress Report

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

**2022 Progress Summary:**

Research Development (RD) hosted 39 events during FY 2022 across four categories with 977 in-person attendees. We reached 386 faculty in FY 2022, 54 more than in FY 2021. Research Development supported 20 full proposals and 14 preliminary proposals in FY 2022, with an overall potential total value of \$687 million. We provided graphic support to 23 proposals, worth a potential value of \$557 million. Strategic intelligence provides analysis to inform strategic decision-making by ASU leaders. In FY 2022, they produced 81 documents overall, with the majority of these being program analyses (26). Program analyses focus on specific funding opportunities that are of high interest to the ASU community. The analysis provides background (past award history) and foreground (capacity at ASU) to increase the competitive nature of proposals designed by ASU investigators. In addition, they produced 18 capacity analyses, which are designed to identify intellectual capacity at the university so that it can be harnessed to pursue large and strategic initiatives. RD disseminated 219 funding opportunities across multiple sponsors. Our internal review program was used for 13 highly competitive opportunities. The transparent, equitable review of applications results in increasing the positioning of subsequent applications to the sponsor agency. This year, the program was able to coordinate 50 faculty and provide robust, timely feedback to all applicants. Note: sponsored funding listed in the metrics are proposals not awards.

**Space Exploration and Optical Sciences highlights**

- RD produced a capacity analysis on photon and light research in support of a larger conceptualization of research in this area.
- RD produced an update memo for ASU leadership that reflected on a 2020 analysis of NASA-funded projects, which served to inform institutional decision-making regarding new investigator development initiatives.
- RD completed several updates to manufacturing capacity documents that illustrated ASU’s depth of expertise across a range of sciences pertinent to manufacturing.
- RD completed analysis of ASU quantum science capacity and an analysis of the quantum institutes federal program.
- RD supported phase 0 and phase 1 of a DARPA proposal for Space-Based Adaptive Communications, which seeks to revolutionize how space-based satellites communicate.

Investment Detail				
	2022	2023	2024	Total
Infrastructure				0
Basic Research	30,059			30,059
Applied Research	30,059			30,059
Development	30,059			30,059
Total	90,177	0	0	90,177

Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0			0
Postdocs Supported	0			0
Graduate Students	0			0
Undergraduate Students	0			0
Sponsored Project Funding	300,000			300,000
Publications in Academic Peer-Reviewed Journals	0			0
License and Options Income	0			0
Startups	0			0
Startup Investments	0			0
Startup FTEs	0			0