

# TRIF 3-YEAR PLAN

ARIZONA STATE UNIVERSITY



ARIZONA BOARD OF  
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## **Executive Summary**

TRIF investment at Arizona State University has been fundamental to elevating ASU as a leading research and educational powerhouse. ASU leverages TRIF to attract growing external investment to our state, providing a threefold return on investment to date. Since TRIF began, ASU has more than quintupled its research expenditures, rising to #6 in the nation for research expenditures among institutions without a medical school.

The university's solutions-focused approach to grand challenges led U.S. News & World Report to name ASU "#1 in innovation" for six consecutive years. Currently, ASU is educating nearly 120,000 students, providing the knowledge, skills and hands-on experience that 21st century employer's demand.

For the next funding cycle of FY 2022-2024, ASU will build on its foundation of TRIF-enabled expertise and infrastructure, developing novel solutions to challenges in our state and the skilled workforce needed to implement them. The university has strategically selected programs and projects that are poised to bring the greatest return on investment to Arizona.

ASU will accelerate the impact of these programs by allocating a portion of TRIF to infrastructure that supports and scales their success. These cross-cutting resources are available to all of the focus areas to help secure external funding, accelerate discoveries and bring innovative solutions to market.

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

## **University Vision and Philosophy**

The goals of TRIF align with ASU's mission as spelled out in its charter:

ASU is a comprehensive public research university, measured not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves.

The charter provides the vision that guides ASU in advancing the following goals:

- **Demonstrate leadership in academic excellence and accessibility.** This includes matching Arizona's socioeconomic diversity with regard to both access and measurable outcomes for success.
- **Establish national standing in academic quality and impact of colleges and schools in every field.** ASU provides Arizona learners with the highest quality education at an affordable cost.
- **Establish ASU as a leading global center for interdisciplinary research, discovery and development by 2025.** The university is on a path toward bringing more than \$1 billion in annual research funding into the state. The outcomes of this research are transforming Arizona's economic competitiveness.

- **Enhance our local impact and social embeddedness.** ASU is empowering 21<sup>st</sup> century learners to co-develop solutions to the social, technical, cultural and environmental issues facing 21<sup>st</sup> century Arizona.

## Expected Outcomes

ASU leverages TRIF investment to achieve the following outcomes:

- **Return on investment.** New externally funded grant awards are a result of strategic alignment of research with challenges that need to be solved and of strong partnerships with leading national and global organizations. This brings additional revenue to the state and creates jobs at the university and with our local partners.
- **Technology transfer.** Patents, licenses and options, and new startup companies represent the translation of research and innovation to the marketplace where they can benefit society.
- **Industry engagement.** By partnering with industry leaders, we leverage our knowledge enterprise for maximal marketplace impact.
- **Workforce contributions.** University students who receive research training understand problem solving and are prepared for the high-tech industries driving our economy.
- **Educational outreach.** ASU leads numerous outreach efforts to spark discovery, learning and entrepreneurship among K-12 students and community members.
- **Government agency/community engagement.** Collaborations with government and community agencies connect our subject matter experts and innovative solutions with organizations working directly with populations in need.

## Marketing/Communication Overview

The Strategic Marketing and Communications Team within ASU's Knowledge Enterprise conveys the value and impact of research and innovation through engaging multimedia storytelling. These communications also create their own impact by sharing new knowledge generated through research with the public.

The team strategically disseminates this content through university websites, mass media, social media, print collaterals, newsletters, presentations and events.

ASU communications on TRIF-enabled programs and projects will include the following key messages:

- TRIF investments are strategically leveraged to support programs with a track record of success as well as emerging high-potential research areas.
- The research and economic development enabled by TRIF has a significant, positive impact on our state and beyond.
- TRIF investments support the training and education of students, contributing to a highly skilled workforce that can fulfill the high-tech jobs being created in Arizona and attract new business and industry to the state.

TRIF-related deliverables for this funding cycle will include:

- Annual TRIF report that outlines accomplishments and return on investment.
- Stories of TRIF-enabled discoveries and impact, told through news articles, feature articles, graphics and videos posted to ASU websites and social media accounts.
- Media pitches on TRIF-enabled discoveries and impact to local, national and international news outlets.

- Marketing collaterals that publicize TRIF-enabled programs and achievements to key stakeholders and potential partners.

### **University Administration of TRIF**

TRIF is administered through the ASU Knowledge Enterprise under the following leadership:

- Sally C. Morton, executive vice president
- Neal Woodbury, vice president for research and chief science and technology officer

Over the next three years, ASU will invest in the following programs under the five TRIF focus areas:

- Improving health
  - Biodesign Institute, led by Joshua LaBaer
  - Institute for the Future of Health, led by George Poste
  - Arizona Wellbeing Commons, led by Joshua LaBaer
- Water, energy and environmental systems
  - Global Futures Laboratory, led by Peter Schlosser
  - LightWorks, led by Gary Dirks
  - Future H2O, led by Dave White
  - Engineering Research Centers, led by Kyle Squires
- National Security Systems
  - Global Security Initiative, led by Nadya Bliss
- Space exploration and optical sciences
  - NewSpace, led by Jim Bell
  - Interplanetary Initiative, led by Lindy Elkins-Tanton
- Access and workforce development
  - Luminosity Lab, led by Mark Naufel
  - J. Orin Edson Entrepreneurship + Innovation Institute, led by Ji Mi Choi
  - MacroTechnology Works/Advanced Electronics and Photonics, led by Kevin Reinhart
  - Advanced Materials Initiative, led by William Petuskey

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# 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
Startups	0	0	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. 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 the externally-funded and mobile food entrepreneurship program, <del>Prepped</del> 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
<b>Total</b>	<b>800,000</b>	<b>800,000</b>	<b>800,000</b>	<b>2,400,000</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	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
Startups	0	0	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			
<p><b>Problem Statement:</b></p> <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>				
<p><b>Program Description:</b></p> <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>				
<p><b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b></p> <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>				
<p><b>Is there an Arizona Specific Benefit or Impact?</b></p> <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>				
<b>Investment Detail</b>				
	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
<b>Total</b>	<b>500,000</b>	<b>500,000</b>	<b>500,000</b>	<b>1,500,000</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	1	1	2	4
Undergraduate Students	12	13	14	39
Sponsored Project Funding	139,851	146,844	154,186	440,881
Startups	0	0	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
Startups	0	0	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			
Problem Statement:	Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.			
Program Description:	Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.			
What is the University's Advantage and/or Anticipated Funding Opportunities?	Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.			
Is there an Arizona Specific Benefit or Impact?	ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.			
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	60,306	60,306	60,306	180,917
Applied Research	60,306	60,306	60,306	180,917
Development	60,306	60,306	60,306	180,917
Total	180,917	180,917	180,917	542,751
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	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
Startups	0	0	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			
<p><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.</p>				
<p><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. 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.</p>				
<p><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 many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill which 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, with the nation’s #1 ranked university for innovation.</p>				
<p><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.</p>				
<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
<b>Total</b>	<b>58,397</b>	<b>58,397</b>	<b>58,397</b>	<b>175,192</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
Startups	5	5	5	15

# 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			
<b>Problem Statement:</b> 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.				
<b>Program Description:</b> 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.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> 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.				
<b>Is there an Arizona Specific Benefit or Impact?</b> Biodesign is committed to 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 as well as other key areas of economic value.				
<b>Investment Detail</b>				
	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
<b>Total</b>	<b>7,580,222</b>	<b>7,580,222</b>	<b>7,580,222</b>	<b>22,740,666</b>
<b>Performance Measures</b>				
	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
Startups	4	4	5	13

# Arizona Board of Regents

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

University:	Arizona State University			
TRIF Investvest Area:	Improving Health			
Program Name:	ACCEL (Arizona Coalition for Comprehensive Evaluation of Long-COVID)			
<p><b>Problem Statement:</b></p> <p>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.</p>				
<p><b>Program Description:</b></p> <p>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</p>				
<p><b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b></p> <p>The scale of the patient populatoin suffering from long-COVID and its statewide impact will benefit from mobilizing tri-unviversity resources to generate the spectrum of clinical, research and computing skills required.</p> <p>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.</p>				
<p><b>Is there an Arizona Specific Benefit or Impact?</b></p> <p>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.</p>				
<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
Startups	0	0	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			
<p><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.</p>				
<p><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.</p>				
<p><b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b>            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. 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, with the nation’s #1 ranked university for innovation. Emerging companies selected for strong potential for next-generation medical technologies/services undergo an immersive curriculum, followed by 12 months of close collaboration, guidance, and tracking. Participants can access fast-track product development collaborations, research, and clinical validation studies with Mayo Clinic and/or medical education and research through ASU.</p>				
<p><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.</p>				
<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
Startups	5	5	5	15

# 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
Startups	0	0	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			
<b>Problem Statement:</b>				
<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>				
<b>Program Description:</b>				
<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>				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b>				
<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>				
<b>Is there an Arizona Specific Benefit or Impact?</b>				
<p>Research Computing has developed capacities in advanced computing and data for initiatives in health, sustainability, space exploration, national security and workforce development that benefit Arizona. 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>				
<b>Investment Detail</b>				
	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
<b>Total</b>	<b>2,295,000</b>	<b>2,295,000</b>	<b>2,295,000</b>	<b>6,885,000</b>
<b>Performance Measures</b>				
	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
Startups	3	3	3	9

# 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			
<b>Problem Statement:</b> 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.				
<b>Program Description:</b> 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.				
<b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b> 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. 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, leading to \$50-55 million in annual DoD expenditures and projected rise in (DoD HERD) ranking to place ASU near the top 20.				
<b>Is there an Arizona Specific Benefit or Impact?</b> 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, 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. A dedicated university security entity helps establish Arizona as a forward-thinking, security-conscious state that can serve as a model for others as the threats to our nation continue to evolve.				
<b>Investment Detail</b>				
	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
<b>Total</b>	<b>2,498,000</b>	<b>2,498,000</b>	<b>2,498,000</b>	<b>7,494,000</b>
<b>Performance Measures</b>				
	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
Startups	2	2	2	6

# 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 addition, ASU researchers working with SI were No. 4 in patents granted, No. 4 in startup companies launched, and No. 3 in inventions disclosed among universities without medical schools, according to a recently released report by the Association of University Technology Managers (AUTM) on FY19 outputs. As a result, ASU was just one of five universities without a medical school ranking in the top 10 for issued patents, startups launched, inventions disclosed, and deal flow (along with Carnegie Mellon, MIT, NC State and Purdue).</p>				
What is the University's Advantage and/or Anticipated Funding Opportunities?				
<p>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. 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.</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
Startups	5	5	5	15

# 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			
Problem Statement:	Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.			
Program Description:	Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.			
What is the University's Advantage and/or Anticipated Funding Opportunities?	Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.			
Is there an Arizona Specific Benefit or Impact?	ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.			
Investment Detail				
	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	41,010	41,010	41,010	123,030
Applied Research	41,010	41,010	41,010	123,030
Development	41,010	41,010	41,010	123,030
Total	123,030	123,030	123,030	369,089
Performance Measures				
	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	0	0	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
Startups	0	0	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			
<p><b>Problem Statement:</b></p> <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. 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>				
<p><b>Program Description:</b></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. TRIF funding supports multiple programs focused on new energy systems, decisions systems and water related research.</p>				
<p><b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b></p> <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>				
<p><b>Is there an Arizona Specific Benefit or Impact?</b></p> <p>1. Transforming Arizona into a hub of carbon capture and synthetic fuel creation, forging partnerships that include the 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 perspectives and data of faculty, State, County, and industry leaders, with the goal to attract approximately \$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>				
<b>Investment Detail</b>				
	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
<b>Total</b>	<b>3,964,500</b>	<b>3,964,500</b>	<b>3,964,500</b>	<b>11,893,500</b>
<b>Performance Measures</b>				
	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
Startups	2	2	2	6

# 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			
<p><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.</p>				
<p><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.</p>				
<p><b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b>            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. 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.</p>				
<p><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.</p>				
<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
<b>Total</b>	<b>1,565,049</b>	<b>1,565,049</b>	<b>1,565,049</b>	<b>4,695,148</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
Startups	5	5	5	15

# 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			
<p>Problem Statement:</p> <p>MacroTechnology Works (MTW) mission is "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." Over the past 2 years ASU has started to develop 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 (available to all) 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>				
<p>Program Description:</p> <p>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. Industry partners executing a lease are required to also commit to funding research activities. 3. Key corporate partners provide opportunities to enhance access to state of the art tools for materials deposition, etch, and characterization and provide opportunities for industry relevant research activities. 4. Engaging with companies at various scales is enabled via a scalable model that engages partners in leased space, core facilities usage, and research collaboration that provides a win-win opportunity for ASU researchers to participate in value added research that aligns with industry needs. 5. Undergraduate, grad student, and post doc participation in research projects and training on industry relevant tools helps to prepare the next generation semiconductor <del>and fab</del></p>				
<p>What is the University's Advantage and/or Anticipated Funding Opportunities?</p> <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>				
<p>Is there an Arizona Specific Benefit or Impact?</p> <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
Startups	9	11	12	32

# 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			
<p><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.</p>				
<p><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.</p>				
<p><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.</p>				
<p><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.</p>				
<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
Startups	0	0	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)			
<p><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.</p>				
<p><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.</p>				
<p><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.</p>				
<p><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.</p>				
<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
<b>Total</b>	<b>400,000</b>	<b>400,000</b>	<b>400,000</b>	<b>1,200,000</b>
<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
Startups	0	0	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 (NEWT)			
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.</p> <p>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. Our technologies are being integrated into water solutions for rural communities to provide clean drinking water. Annually we bring undergraduates from Arizona Community colleges and high school teachers from Arizona into our research labs for organized, paid, summer research experiences.</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
Startups	0	0	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> Core Facilities mission: To facilitate the expansion and enhancement of ASU's research enterprise by providing technical and scientific services to support faculty research objectives and enable success.				
<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 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 with which we 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
Startups	5	6	6	17

# 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			
<p><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.</p>				
<p><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.</p> <p>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.</p>				
<p><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.</p> <p>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.</p>				
<p><b>Is there an Arizona Specific Benefit or Impact?</b>            The initiative's novel learning programs will directly benefit learners and businesses based in Arizona. For example, OpenCitizen meets learners wherever they are — in the home or the workplace — and connects their learning experience to what matters most to them in their communities. OpenCitizen's local problem solving focus benefits Arizona by empowering its citizens to make positive changes in their community while gaining new skills. The Technological Leadership B.S., which has just completed its first year and offers a radically different learning experience in which students direct their own learning through research processes, enrolled 18 students living in Arizona. Moreover, the Interplanetary Initiative strengthens ASU's relationships with the robust aerospace industry in Arizona through workforce development and research partnerships.</p>				
<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
Startups	0	0	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:	Materials of the Universe			
<p><b>Problem Statement:</b>          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. These problems are closely related and form a <u>new field, which we call materials of the universe.</u></p>				
<p><b>Program Description:</b>          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>				
<p><b>What is the University's Advantage and/or Anticipated Funding Opportunities?</b>          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>				
<p><b>Is there an Arizona Specific Benefit or Impact?</b>          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>				
<b>Investment Detail</b>				
	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
<b>Performance Measures</b>				
	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
Startups	0	0	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>The exponential growth in the commercial space industry provides an enormous opportunity for universities to partner with commercial space companies to seek funding from federal agencies for education, science and technology, workforce development and national security. 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. The ASU Space Technology and Science (NewSpace) Initiative 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>Morgan Stanley predicts that by 2040, the space economy will be over \$1 trillion. 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
Startups	0	0	1	1

# 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			
<p><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.</p>				
<p><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.</p>				
<p><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.</p>				
<p><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.</p>				
<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
Startups	0	0	0	0