EXECUTIVE SUMMARY

Item Name: **Request to Approve Arizona State University's Proposal for the Use of TRIF Supported Opportunity Initiative Funds**

☒ Action Item

> **Requested Action:** Arizona State University asks the board to approve the university's proposal to expend $10 million in TRIF Opportunity Initiative funds for research and Arizona workforce development.

Background/History of Previous Board Action

Arizona law established TRIF from Proposition 301 state sales tax revenue and gives ABOR the authority to administer the fund on universities' behalf.

In compliance with the TRIF statute, the board allocates funding to the university to invest in programs that address one of the five strategic research and workforce areas:
- Improving Health;
- Water, Environment and Energy Solutions;
- National Security Systems;
- Space Exploration and Optical Solutions, and
- Workforce Development.

Discussion

In FY 2021, the board received more TRIF revenue than originally budgeted. The board is distributing to the universities a significant portion of the additional revenue received as TRIF Opportunity Initiative Funds. The TRIF Opportunity Initiative funding totals $40 million in FY 2022. This one-time funding is allocated as follows:
- $10 million to ASU
- $20 million to NAU
- $10 million to UArizona.

Each university is asked to submit a proposal explaining how the institution intends to expend its portion of the Opportunity Initiative funding in accordance with board expectations and TRIF statutory requirements.

ASU is proposing to use its $10 million allocation to launch new programs with the specific goal of transitioning technologies and generating the necessary human resources in areas of greatest economic benefit for the state of Arizona. The full

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proposal is attached.

Committee Review and Recommendation

The Research and Health Sciences Committee reviewed this item at its January 27, 2022 meeting and recommended forwarding the item to the full board for approval.

Statutory/Policy Requirements

A.R.S. §15-1648 "Technology and Research Initiative Fund"

ABOR Policy 3-412 "Administration of Technology and Research Initiative Fund"

Proposed Strategy for Investing Additional $10M in TRIF Funds at Arizona State University

We currently have an unprecedented opportunity to expand the knowledge-based economy of Arizona. Arizona has key challenges and opportunities in the areas of energy, sustainability, transportation, cyber security, AI and computing, quantum technologies, supply chain, pandemic response capabilities and health equity. ASU is a technology leader in these areas in the state, but there is a need to move ideas, concepts, and innovation more rapidly and effectively from university labs to application and to develop the workforce that will enable their implementation.

The $10M of additional TRIF funds provided by ABOR will be used to accomplish this goal by strategically investing these funds in projects designed to launch new programs with the specific goal of transitioning technology and generating the necessary human resources in areas of greatest economic benefit for the state of Arizona.

Energy and Sustainability ($1.5M)

ASU has made a huge commitment to a robust and sustainable future for the planet through the creation of the Global Futures Laboratory. This pan-ASU effort will soon be headquartered in a new state of the art building (pictured to the right). While new technology is a major aspect of the solution space that will need to be developed in order to lay the foundation for a sustainable economy in Arizona, the research and educational programs required to implement these technologies is far broader, involving social sciences, law, policy and economics. Below are 4 key projects that will directly impact the Arizona economy and, in the process, train students for these emerging industries.

> **Hydrogen Generation.** Arizona is a logical place for a major push in hydrogen production and utilization. The large solar capacity of the state coupled with the presence of the Palo Verde nuclear plant provide the needed energy. ASU has a strong, long-term partnership with the major power utilities in the state and has a recognized global leadership position for R&D in sustainable thermochemical hydrogen, syngas and ammonia. This also couples directly with carbon capture (below) for synthetic fuel production. Funds will be used to establish an integrated transdisciplinary research and training effort and to allow ASU to coordinate the many necessary partners needed to position us to be major participants in this opportunity. This is an area where additional federal dollars are available to sustain the effort longer term. It represents key opportunity for students, particularly in our School of Sustainability, to receive hands-on training at both the undergraduate and graduate level in a rapidly emerging area of development.

ASU Now - Arizona State University
Popular Science picks ASU professor's 'MechanicalTree' as a 2019 top technology | ASU News

> **Carbon Capture/Conversion.** This is closely relates to the hydrogen effort, both in terms of integration into overall solutions for the carbon dioxide problem, and in terms of student training at all levels. Our Center for Negative Carbon Emissions already has the basic technology well under development with a strong commercial partner (see

"mechanical tree" above). However, there remain major problems to be solved in the materials that are used, the policy elements that need to be put in place, the economic factors and the overall manufacturing and recyclability of the devices used, particularly given the ultimate scale of the activity. By joining this with the production of hydrogen, carbon dioxide can be converted back into synthetic fuels, a sustainable cycle.

As with the hydrogen hub, the TRIF funds will be used to launch the project with an integrated team from across the university to accelerate our research and to enhance our curriculum as well as facilitating the convening of critical industrial partners that will be needed to succeed in this endeavor. Carbon capture and conversion is likely to become a multi-trillion dollar industry, and with our solar and nuclear energy resources for driving the process, Arizona should be a major player in this emerging carbon/energy economy. A critical aspect of this, once again, is the workforce training component and here ASU is already a leader in the country, both in terms of numbers (one of the largest producers of STEM majors) and in terms of content (the first School of Sustainability).

Electrification of Transportation. A key need in the electrification of private transportation in the state is going to be creating the appropriate network of charging stations and providing the necessary power to those stations at the right times. This is a far more complex issue than one might think, and funding will be used to develop the statewide models that will be needed to put such a network in place. This will be enabled by our decision theater (see below) that provides the analytical tools our researchers will use to create models that decision makers in the state can use to move the process forward in an environmentally and economically responsible fashion. The decision theater is a key training ground for both undergraduate and graduate students learning how to integrate visualization, subject matter expertise and algorithms to create powerful decision-making tools. This is a perfect problem for them to train on that will result in tangible and impactful outcomes.

Grid Security and Stability. Recent events have shown us just how vulnerable we are to both

ASU Cybersecurity Club

intentional cyber-attacks on our electric grid and how important intelligent monitoring and control systems are to avoiding grid instabilities and large-scale damage. ASU has a history of research and education in cyber security and control of these complex systems and a strong research base in power electronics (the picture below shows the ASU Global Security Initiative organizers of the DEF CON capture the

flag event, which is described as the "Olympics of Hacking"). Student engagement in these activities is ubiquitous and direct. This is a critical workforce need in the state and country, and funds will be used to accelerate our programs in this area, providing greatly expanded opportunities for student engagement and putting us in an excellent position to obtain long-term sustainable funding from federal and state sources.

Pandemic Resilience and Preparedness ($2.5M)

ASU has been a major participant in [ADHS's Pandemic Response and Resilience](#) planning program, which is part of the [Arizona Health Improvement Plan](#). Through this involvement we have developed a clear concept of the research required to meet many of the critical needs that the state has in navigating preparing for future health challenges, particularly in infectious disease.

Arizona Health Observatory. As we have seen throughout the pandemic, the ability to act quickly and appropriately when a disease or health challenge first appears is strongly dependent on our knowledge of the spread and characteristics of disease. This will continue to be a critical need in optimizing the health of the state going forward, and developing methods for monitoring a wide variety of viruses, other pathogens or health threats in the population as soon as the occur will save lives not only during a pandemic but in more typical periods when viruses like influenza and RSV flare up or when specific environmental conditions (e.g., water or air contamination) pose a threat. ASU's experience during the pandemic with [testing](#), [sequencing](#), [wastewater analysis](#), [modeling](#) and setting up [vaccination sites](#) has prepared us to take on a broader role in monitoring and analysis in Arizona. We propose to create the Arizona Health Observatory that will unify health data from many sources including patient information, data from ASU-initiated IRB approved research and clinical trials, as well as publicly available data. The technical focus will be in the development of new or enhanced monitoring systems and analytical methods. Integrated into this will be a strong focus on creating the associated workforce of scientists and engineers with the knowledge of how to apply these approaches at scale. We will apply this system in translational and health equity research programs to identify locations, communities, and populations that are in greatest need at any particular time of supporting services and programs. Launching this integrated effort will put us in a much better position to leverage sustainable federal, state, and other funding associated with pandemic preparedness. In addition to the STEM workforce, there is a critical need in the state for workforce development more broadly in the healthcare sector. This program will create real-world opportunities for training tomorrow's healthcare professionals, such as the nurses being trained in our [Edson College of nursing](#) with over 5000 undergraduate and graduate students.

Health Supply Chain Resilience. One aspect of our economy that has been hard hit during the pandemic is supply chain. This has been particularly critical in healthcare where lack of appropriate medicines, materials, machines, and safety measures continues to plague the ability of hospitals to serve their patients. ASU has one of the strongest supply chain research and educational groups in the country in our [W.P. Carey Business School](#). We will use TRIF funding to integrate our existing supply chain expertise with our experts in healthcare delivery forming a powerful team to develop, in concert with our decision theater (see below), models for supply chain management both by hospitals and more broadly. Such tools will be invaluable for rapidly identifying likely vulnerabilities in future health challenges. This will position us for long-term funding opportunities and provide hands-on training for students in [health supply chain management](#).

Innovation Infrastructure ($1M)

For nearly two years, ASU has been a major player in the National Security Innovation Network (NSIN), a Department of Defense network designed to develop better ways of moving technology from concept to implementation. The major focus thus far has been engaging students in design projects and working to transition technology to startups (for example, Hacking For Defense with the Army). To date, we've had over 400 students and 72 faculty participate in this effort to get more than 132 solutions adopted and create 23 dual-use startups. In the NSIN year in review that was just released, the NSIN leadership allotted an entire page to ASU activities (see below, no other university participant had this) that was titled, "*Arizona State University Exemplifies the Future of Defense*". We now have an opportunity to expand in another key area, direct translation of technologies to DoD and associated industries.

> **Department of Defense (DoD) Innovation Accelerator.** Through the NSIN program, we have developed strong relationships with Air Force, Army, and Space Force, and this has opened up new opportunities for collaboration and funding directly from DoD for translation of ASU technology. Key to this are the testing ranges we have in Arizona at Fort Huachuca, Luke Air Force Base and Yuma Proving Grounds. The ability to move technology into fieldable prototypes greatly speeds up the process of implementation and commercialization. DoD facilities and DoD based industry are key players in the Arizona economy, and this work will accelerate the pace of the local defense instillation and industry growth. We will use TRIF funds to create an innovation accelerator capability designed to build the fieldable prototypes ready for testing and training on DoD ranges in Arizona. This makes it possible for DoD to work shoulder to shoulder with ASU researchers and students to develop exactly what is needed for the application at hand. It is also a fantastic opportunity for ASU students to directly engage in DoD projects, gaining valuable experience so they can enter either DoD or DoD based industry in Arizona.

Arizona State University Exemplifies the Future of Defense

For the sixth year-in-a-row, U.S. News and World Report ranked Arizona State University (ASU) first in innovation programs for students. The university is located near several active-duty military bases and large defense industry companies, and ASU is leveraging these local assets to lead national security innovation through a diverse set of NSIN programs such as Hacking for Defense (H4D), National Security Academic Accelerator (NSA2), Hacks, and X-Force.

In 2019 NSIN established its first university program director at ASU and since that time, the successes of students and startups through NSIN programming on campus have accelerated economic development and dual-use technology for commercial and military purposes across the world.

"For us to be strategic in the way that we're deploying our programs and connecting dots, it's most helpful to have somebody on the ground," said Samantha Hiller, NSIN's ASU university program director. "My goal here is to turn Arizona's defense footprint into an ecosystem, with ASU at the center."

While many states have great research universities, startup accelerators, or military partnerships, the challenge is to connect them all and create a community where ideas flourish. Hiller has built a network for defense innovation at ASU to thrive in NSIN programs. A few highlights from the past year:

NSA2
The NSA2 program at ASU creates opportunities for faculty, researchers, and students to solve national security problems. During the program's inaugural year in 2020-21, 27 ASU teams advanced 16 technologies. In addition, the researchers are expanding their Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.

Hacks
Two ASU students teamed up to develop the winning solution at the summer NSIN Hacks event "Polar Vortex: Hacking the Arctic" with their geospatial technology for national intelligence work in the austere Arctic environment.

Before they met at Hacks, one student had his own defense tech startup in Phoenix, and the other was a finalist at another Hacks event. Through the Hacks process, the duo created a new company, Polaris Communications. Today, NSIN is guiding them toward a DoD follow-on contract to build a prototype.

X-Force
Through the NSIN X-Force Fellowship, two ASU students worked with Luke Air Force Base (AFB) to develop a database for sharing emergency information. Today, the students plan to continue work on their solution for Luke AFB through the NSIN Vector program which works with NSIN alumni to develop their solutions into dual-use businesses.

H4D
Two ASU students in an H4D class worked with the Air Force Research Laboratory (AFRL) to develop a new process for measuring core body temperatures. The students formed a company, Isocore Technologies, and now work with AFRL to bring the product to the pararescue and firefighter communities, who rely on core body temperature monitoring to keep their teammates safe and healthy.

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Quantum Technologies ($3M)

Thus far, industries based in Arizona have not been deeply involved in quantum technologies. In order to change that, we not only need to further develop the expertise in our universities and the educational programs for workforce development, we also need to develop key partnerships with established industrial players like IBM and Google.

IBM Quantum Hub. IBM recently invited ASU to join the IBM Quantum program as a 'Hub' partner. This type of enrollment has been primarily limited to national labs and entire countries such as Japan. IBM recognizes that ASU has unrivaled capacity for education and workforce program development. These areas must be addressed to support the advancement and

quantum hub at NC state
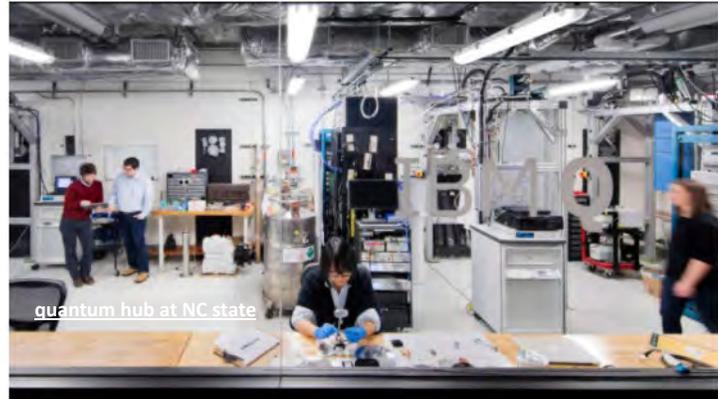
future deployment of the quantum information system architecture. Google is also interested in joint quantum information systems education and workforce development. We plan to establish ASU as an IBM Quantum Hub strategically focusing on quantum information supply chain, software engineering, education, and workforce development.

Augmented Intelligence (AI) and Decision Making ($2M)

Several of the proposals described above reference the use of the decision theater as one of the approaches for collaborative analysis, deliberation and decision making. It has been used by companies, government organizations and researchers for a wide variety of purposes. It is now in need of expansion and modernization in order for it to become the critical resource to Arizona decision makers that we intended it to become.

Decision Theater. While the picture below depicts the "drum" which is one of the convening sites associated with the decision theater, decision theater is not a place. Nor is decision theater a technology or algorithm or set of hardware, though it involves all of those. Decision theater is a collaboration platform in which technologists, data scientists, subject matter experts and decision makers can work together to organize and visualize data and predictive algorithms which allow one to ask the "what if" questions in real time and understand quickly the options and their likely consequences. There is now tremendous interest from a variety of organizations

inside and outside of Arizona to work with us to solve problem in this context. To meet these needs, which ultimately enable substantial long-term funding opportunities in multiple areas, we need to invest in the expansion and modernization of the existing system now. The work done in the decision theater involves students in all aspects of the process. This is a fantastic tool for experiential learning across many disciplines.