

University of Nevada, Reno

Nevada Center for Applied Research (NCAR)

A best-in-class, stand-alone, fully functional applied research and development technology center that serves to enhance the global competitiveness of the Nevada industry by leveraging the physical and intellectual assets of the University of Nevada, Reno (UNR).

Annual Progress Report

Reporting Period: November 1, 2021, to April 30, 2022

May 2022

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Nevada Center for Applied Research "Matching industry needs with academic goals"

Section I: Project Purpose

VISION

The Nevada Center for Applied Research (NCAR) will be a best-in-class, stand-alone, fully functional applied research and development technology center that serves to enhance the global competitiveness of Nevada industry by leveraging the physical and intellectual assets of the University of Nevada, Reno (UNR).

OVERARCHING MISSION

Expand and improve the already established professional, flexible, sustainable, market-responsive technology innovation center that serves to stimulate regional innovation-based economic development by aligning the needs of industry, startup companies, researchers, and entrepreneurs with resources at University of Nevada, Reno.

NCAR will continue to be a central and public access point to utilize the broad range of technical services, intellectual capital, testing and research capabilities, advanced tools, and methodologies available at NCAR's Shared Research Facilities. As a one-stop shop for applied research, NCAR's mission is to help industries:

- Establish collaborative relationships between industry and academia that promote open innovation research programs and scientific studies to address real-world problems.
- Facilitate industry access to cutting-edge shared research laboratories and sophisticated instrumentation and equipment.
- Build an interdisciplinary team of faculty, scientists, postdoctoral students, and graduate students to work on ongoing or one-off projects, or new-complex developments.
- Provide access to an entrepreneurs' support network that includes incubation and business mentoring from experienced entrepreneurs and executives.
- Provide reduced cost co-working space available to the University community and local startups.

Along with the already existing infrastructure (Shared Research Facilities and Core Lab), NCAR has leveraged the new initiatives and associated infrastructure created between 2016-2022 that were designed to provide value to industry and to be closely aligned with strategic university programs. Matching Industry Needs with Academic Goals

GOALS

To enhance the development of programs that provide industry with a broad range of technical services, intellectual capital, testing and research capabilities, advanced tools and methodologies in Science and Engineering; helping to nurture the economic development of the State of Nevada.

Main foci are i) Robotics, ii) Life Sciences, and iii) Advanced Manufacturing, including the breadth of relevant fields and the convergence with other disciplines. The High-Performance Computing Facility (HPC) project initiated during 2016, will be used as a supporting infrastructure for all programs. NCAR will also provide fee-for-service access to the HPC for companies in need of this system. In addition, NCAR will continue to offer fast and effective access to more than 40 Shared Research Facilities and Core Labs to support these programs.



Section II: Proposal Progress

During this reporting quarter, the Nevada Center for Applied Research (NCAR) has made progress toward meeting proposed metrics. Major accomplishments for the current reporting period include:

Section II. A) NCAR MANAGEMENT: Create a Stand-Alone Research and Development Technology Center to Enhance the Global Competitiveness of Nevada Industry.

Accomplishments

The positive trend of services and activities experience by NCAR during the previous reporting period (during the pick of the COVID-19 pandemic), has continued during this reporting period. This has created a significant increase that, in the entrepreneurial, scientific, financial, and administrative activities of the center.

The shared sterilization room has been completed along with significant improvements in several areas in the Applied Research Facility (ARF), which made this building on campus a very active one and a central location for companies, entrepreneurs, faculty, and students to develop applied research with major focus on life sciences and robotics.

In collaboration with agencies and industry partners grants development and submission continuous to be an integral part of NCAR operations. Relationships with UNR faculty, Shared research facilities and Core Labs is strong and NCAR continue these relationships as they are one of the core components of the center and help promote UNR resources for industry and entrepreneurs.

During this reporting period NCAR operations:

- Invoiced a total of <u>\$305,839</u> in Fee for Service and Facility and Equipment Use Agreements
- Provided fee-for-service agreements to 48 and use of facility agreements to 34 companies and agencies.
- Onboarded <u>8</u> new companies as affiliated entities housed on campus.
- The new companies added 28 new jobs.

Current summary of the Knowledge Fund investment can be found on Page 25, Section V: Knowledge Fund Investment - Summary



Commercialization and Partnering Activities

NCAR currently has 23 affiliated companies working on campus and more than 130 companies and entities that have performed one or more types of fee-for-service or facility use agreements with UNR labs, faculty members and students.

Programmatic and Project Changes

A significant addition to the program is the creation of an Executive Director, Corporate Partnerships position that is responsible for developing and executing a strategy to foster high-level partnerships with large industry that bring financial, technological, and intellectual resources to UNR and contribute to the growth of research and innovation. The goal is to have the executive director to effectively collaborates with deans and other University leaders to understand strategic initiatives across all disciplines/units and to connect researchers with external partners. Although this is an activity that NCAR has been performing since inception, with transactional activities with corporate partners, now we will also be seeking large and longer-term corporate-sponsored research and development activities.

Looking Forward

We are planning to keep the successful trend of activities with NCAR, but also focusing on adding large and longer-term corporate-sponsored research and development activities with UNR.



Nevada Center for Applied Research "MATCHING INDUSTRY NEEDS WITH ACADEMIC GOALS"

Section II. B) ROBOTICS: Create a state-wide "Institute of Service Science and Engineering"

Accomplishments

The Intelligent Mobility (IM) initiative has restarted and completed the main phase for instrumenting most intersections in the Living Lab corridor in Reno. After some delays due to the pandemic and lack of City Works personnel availability, all sensors were installed, and traffic boxes instrumented. We completed the integration of the fiber optic networks from the City of Reno an the one on UNR Campus. At this point, we have a working communication infrastructure, instrumented intersections and cabinets, a data management plan in place and an initial development of AI-based traffic applications

The Digital Twins project in collaboration with RTCW, a DOT is being developed. We are moving forward with the developments to demonstrate that the sensors, computers, and network equipment necessary for building and maintaining digital twins of transit infrastructure can be placed on RTC buses rather than on fixed infrastructure. Each time a bus drives past a piece of transit infrastructure, sensors on the bus will update the infrastructure's digital twin, using modern machine learning technology to automatically identify any changes (say, damaged signage or graffiti) and notifying authorities of maintenance needs in real time. By instrumenting a bus with 3D laser scanners (lidar), GPS, and cameras, we will show how a single vehicle can cost-effectively monitor a large region.

We completed the preparation phase and ready to initiate a pilot program between RTCW, UNR and limportant safety Technology USA, Inc. (A Berkeley, CA Company). The project will add a safety component around the living lab using our autonomous vehicle test bed and a fleet of electric buses to protect pedestrians for the benefit of the public in Washoe County.

The development of Living Laboratories in Northern Nevada for real-life, urban testbeds for autonomous and connected vehicles and intelligent traffic control system offer real potentials for economic development as this is attracting companies and agencies to the region.

Mass Transit Autonomous System Data

The NCAR Intelligent Mobility team has been working with the City of Reno and the Washoe County RTC to develop intelligent data collection systems for public transit and infrastructure systems. The IM team has deployed intelligent sensors in the Living Lab Corridor in the city of Reno and has connected those sensors to a private computer network that effectively extend the "vision" of the Artemis automated vehicle platform.



Autonomous Vehicle Program

The Intelligent Mobility team has been engaged in several research projects developing advanced technologies to improve autonomous vehicles. These technologies include GPU-Accelerated Algorithms for Robotics, Pedestrian Behavior Prediction, and Neural Ordinary Differential Equations for Automated Driving. The following activities were performed during the reporting period:

(a) A Mapping system of the entire Living Lab in Reno

(b) An AV Data Center with datasets collected on the AV routes for training and testing AI-driven algorithms. The data collection will be done throughout the year to see the effect of different weather conditions.

(c) To install a 5G network and additional sensors on the Living Lab to provide V2X connectivity for enhanced safety.

(d) R&D Program to address safety and operational issues for AV implementation in Reno and across Nevada road network.

We are looking for a telecon company to partner with us with the goal of implementing the 5G network for autonomous vehicle in the Living Lab (not successful yet)

We have Memorandum of Understanding in place with the Israeli Living Lab in Tel Aviv and with Khalifa University in Abu Dhabi. We are working with both groups on specific data collection and data sharing programs related to how autonomous vehicles should handle all weather conditions and road topologies. Working on such diverse datasets collected from various regions and under different environmental conditions will be a key project to engage new stakeholders in this program.

Connected Infrastructure

All edge cabinets at the intersections are ready with the following features:

- Each edge cabinet connects 2 LiDAR sensors to a DS1200 Edge Computer
- This Fiber Network connects back to Campus through a switch located in the Virginia & Artemesia Street Cabinet
- All Edge Machines aShare this 100 Mb Multi-modal Fiber connection provided by the City of Reno
- The Artemesia Street cabinet also contains a DS1100 Edge Computer for use with a PerfSonar Mesh used for network telemetry testing.

The current deployment status is as follows:

DS 1200 Edge Computers

- Dual Boot Linux/Windows
- Connect directly to LiDAR sensors
- Connect directly to City Fiber
- NetPlan locked down to prevent unauthorized access

DS 1100 Edge Computer

- Configured as a PerfSonar Box
- Used for network telemetry testing LiDAR Sensors



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- Unicast only to their assigned Edge Computer
- Configurable through web service

The Living Lab connected infrastructure right now is one of the largest of this type and the anticipated applications, among others, include:

Cyberinfrastructure and Cybersecurity

- Upgrade Plans
 - Multi-modal fiber has a theoretical throughput of 1.2 GB
 - We were limited to 100Mb by port restrictions on the City of Reno side of the cabinet
 - Hardware has been purchased to allow our Edge Network to utilize this
 - Currently we are awaiting delivery of hardware to the City of Reno and an installation date to increase speed of the Edge Network
- Future Work
 - Deployment of Edge Computers at 6th, 5th, and 4th street
- High-Level current infrastructure is shown below:



Socioeconomic Impact

A new study on socioeconomic impact will be part of the pilot program in collaboration with RTC and the company limportant Safety Technology).

Next Steps and Upcoming Grant Submission:

- NSF-SCC (PG)
 - SCC-PG: A critical assessment of bicyclist and pedestrian safety in Reno, Nevada
 - 1) Recruit ~500 bicyclists/pedestrians to complete a survey, identifying unsafe locations (interactive map or text entry)
 - 2) Identify 4-5 locations to deploy mobile LiDAR sensors in safe & unsafe locations
 - 3) Track 1 grant: community workshop + wider distribution + implementation



- Community Partners in Place
 - Alta Planning
 - RTC
- Expected submission mid to late summer
- NSF-SCC (PG)
 - SCC-PG: Towards a Smarter Transportation Network in the Lake Tahoe Community
 - 1) Geodesign workshop to identify (problematic) locations
 - 2) deploy road and trailside sensors and assess/share pilot collected data
 - Community Partners in Place
 - TTD
- NSF-GSS
 - Nevada Statewide alternative and automated vehicle survey
 - Interest, access to, (un)willingness to adopt
 - Rural vs. suburban vs. urban
 - Critically evaluate correspondence with infrastructure planning aims and policies

Legal and Regulatory Implications

New work is being planned with the Social Psychology group at UNR and the National Judicial College. Focus could be on legal implications again but also data usage and regulations.

Nevada Advanced Autonomous Systems Innovation Center (NAASIC)

NAASIC is continuously apporting expertise for ground autonomous vehicle technology for the IM initiative in the R&D labs in ARF. We keep outreaching industry partners and technology companies that may be interested in joint developments. We also work with specialized faculty identifying grant opportunities for autonomous systems.

Autonomous Robots Arena

NCAR will continue to support and improve the general capabilities of the Autonomous Robot Arena in ARF. We are renovating the high-bay area at the Applied Research Facility to make a more efficient area for robotic development and add new features and capabilities to the Robot Arena to make it appealing for local and regional drone companies.

Nevada Autonomous

The University of Nevada, Reno has launched <u>Nevada Autonomous</u>, a new program to manage and enhance Nevada's Unmanned Aircraft Systems (UAS) Test Site activities. The UAS Test Site service was created following Nevada's designation by the Federal Aviation Administration as one of seven states to serve as a center for the development and testing of unmanned autonomous vehicles and systems.

Nevada Autonomous will be responsive to opportunities statewide and will collaborate with projects developed through the University of Nevada, Las Vegas, and Desert Research Institute. The new alignment better incorporates UAS test activities with the aeronautical, autonomous vehicle and robotics research happening at the three research institutions of the Nevada System of Higher Education, while continuing to also facilitate testing opportunities with business, industry, and government agencies. Safety will remain a primary emphasis. Nevada Autonomous is part of the



Nevada Center for Applied Research and will be using all technical resources and business development expertise from NCAR to attract new companies and agencies to the state of Nevada.

Commercialization and Partnering Activities

Several partnerships were established for the development and submission of different grant applications for DOT, NSF and DOE. The grant proposal presented to the DOE was invited to submit a full proposal.

Programmatic and Project Changes

The addition of Nevada Autonomous will incorporate some new dynamic to the NCAR operations but no significant departure from our current program is anticipated.

Looking Forward

NCAR will continue the development and implementation of the Intelligent Mobility Initiative, focusing on the full implementation and expansion of the Living Lab. NCAR is also developing a new strategic plan for corporate outreach to attract companies, agencies and talent to this program, the goal is to have this initiative fueled by industry-driven programs.

As we advance with developments in both ground and areal robots, we are expecting to reach out to a larger number of companies that may be interested in collaborative research, development or licensing the current technology. NCAR will continue exploring both commercial and academic opportunities for NAASIC, including a closer collaboration with NIAS.



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Section II. C) LIFE SCIENCE: Create a self-supporting Bio-tech Hub in the Applied Research Facility

Accomplishments

NCAR is providing highly innovative fast-growing companies an access point to the university and its resources for instance faculty expertise, intellectual capital (IP), critical equipment, infrastructure like the Living Lab, and vital laboratory space for their development. NCAR is providing businesses with a safe zone to foster their growth as well as offering innovation on demand. After a period of successful business incubations in NCAR, three technology companies that were incubated in NCAR have emerged as viable companies and have outgrown our operation.

During this reporting period continue the of companies and influx had several new biotechnology companies in the Applied Research Facility

NCAR is currently negotiation with four new biotech companies to establish their operations at the Applied Research Facilities. Most likely these companies will be introduced in the next reporting period.

The Shared Sterilization room is completed and ARF now has a new shared biosciences infrastructure room housing a central use autoclave, an ultrapure water system and a flake ice machine. All of these items are necessary and considered daily, basic necessities for not only biotechnology (i.e. molecular biology) research, but wet lab operations in general. Now we are assessing the need to install an industrial, bio-tech oriented dishwasher for the same room. The addition of the autoclave will allow us to reduce the costs biowaste management that is currently subcontracted to a third party.

BioBUBBLE Containment Environment

A large study sponsored by the NIH and executed by the College of Public Health is being executed in this space and supported by NCAR.

Genomics

The Nevada Genomics Center (NGC) was reallocated to ARF in a more dynamic space for the center and it is fully operational. NGC is now closer, not only to NSHE users on campus, but also to all NCAR industry partners that may need to utilize its services.

Magnetic Resonance Image

Use of the functional Magnetic Resonance Imaging (fMRI) scanner at Renown continue to operate as a Core Lab and it was successfully incorporated as part of a larger imaging core using the iLab System.

Proteomics Center

The Mick Hitchcock Nevada Proteomic Center will continue to provide cutting edge mass spectral approaches for proteomic researcher within NSHE. NCAR will continue a campaign to expose these

services to industry working with the Proteomics Center team to improve industry access to the services.

Bioinformatics

The Nevada Center for Bioinformatics was successfully moved to ARF and is fully operational. We are working now on enhancing this core facility and the bioinformatics research resources, services and training in support existing research programs, development of new programs and develop a more comprehensive portfolio of services for industry clients. We will work on a system to incorporate these services with HPC resources.

Commercialization and Partnering Activities

N/A

Programmatic and Project Changes

N/A

Looking Forward

The expansion of the Bioscience Entrepreneurial Lab system, the establishment of the Genomic, Bioinformatic, and Advance Imaging cores in ARF, along with the large number of biotechnology resources already offered on campus is creating a unique environment for biotechnology development. Due to the large number of NCAR affiliated companies in the Applied research Facility, we are down to just few labs left, which presents a problem as more companies are looking to collaborate with the University and establish their operations on campus.



Section II. D) ADVANCED MANUFACTURING: Establish an NSF & industry-funded "Industry University Cooperative Research Center" (IUCRC); a consortium of partnering companies and Universities with the objective of translating university research into industrial applications and patents.

Accomplishments

NCAR is now collaborating with Nevada Industry Excellence (NVIE) in the development of a strategy to 1) connect NVIE customers seeking R&D to NCAR and 2) connecting NCAR customers moving from prototyping to production to NVIE. It is expected that this two-way collaboration will benefit local and regional companies and attract more out-of-state companies.

Although NCAR does not currently have enough resources to establish an IUCRC. The collaboration with NVIE and the collection of current UNR resources form the basis for this future development. The following labs are the basis for advance manufacturing: Material Characterization Nevada, Advanced Manufacturing and Material Processing Laboratory, Mechanical Engineering Manufacturing Lab, Mechanical Engineering Multiphysics Laboratory, Center for Civil Engineering Earthquake Research, Mackay School of Earth Science and Engineering Microbeam Laboratory. NCAR will eventually coordinate efforts and the pool of faculty necessary for advance manufacturing techniques and models.

Commercialization and Partnering Activities

N/A

Programmatic and Project Changes

N/A

Looking Forward

Once an internal framework for advanced manufacturing is defined, we will attempt to find a group of initial industry partners that can pilot this effort. Industry partners can be selected from NCAR affiliated companies, as well as companies from NVIE portfolio.



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Section II. E) HIGH PERFORMANCE COMPUTING FACILITY (HPC) FACILITY

Accomplishments

The High-Throughput Computing modules we setup for Intelligent Mobility is working well and we can use this model for other real-time/near-real-time projects and applications. The HPC has the iLAB system implemented for faculty to use the resource and we have a fee for service mechanism for companies to access. The external usage of the HPC during this reporting period is very low but we are working on ideas to promote its use.

Commercialization and Partnering Activities

N/A

Programmatic and Project Changes

N/A

Looking Forward

NCAR Associations are being promoted and access to the HPC resource is available for industry partners and initiatives.



Section II. F) OTHER PROPOSAL DEVELOPMENT

To increase multi-disciplinary activities and collaboration with faculty members and start-ups/spinouts and other companies, NCAR has been supporting/developing different grant applications. See Table 1 in the Performance Section.

Table 1. Awarueu Grant -	- Supported by NCAR'S	incubating companies and/or Developed by NCA	
Category	Recipient	Awarding Entity	Amount
**Health Science	UNR/NCAR	Strategic Progress, LLC	\$50,000
**Cybersecurity	UNR/NCAR Innovative Res Analysis	Office of Homeland Security	\$100,000
**Biosciences Administration	IDeA Network of Biomedical Research (INBRE)/NCAR	National Institute of General Medical Sciences	\$300,000
**Bioscience	UNR-DxDiscovery	National Institute of Health	600,000
**Bioscience	UNR-DxDiscovery	National Institute of Health	589,866
**Bioscience	UNR-DxDiscovery	National Institute of Health	1,453,291
**Bioscience	UNR-DxDiscovery	US Department of Defense	200,000
**Bioscience	UNR-DxDiscovery	National Institute of Health	600,000
**Bioscience	UNR-DxDiscovery	US Department of Defense	999,899
**Bioscience	UNR-DxDiscovery	US Department of Defense	150,000
**Bioscience	UNR-DxDiscovery	National Institute of Health	420,640
**Bioscience	UNR-DxDiscovery	US Department of Defense	999,395
**Bioscience	UNR-DxDiscovery	National Institute of Health	25,000
**Battery Development	NexTech Batteries	Department of Defense	\$250,000
**Bioscience	UNR-EscaZyme	National Institute of Health	\$124,000
**Bioscience	UNR-EscaZyme	STTR	\$225,000
**Bioscience	UNR-EscaZyme	STTR	\$225,000
**Bioscience	UNR-EscaZyme	Private Partner	\$530,000
**Bioscience	UNR-EscaZyme	STTR	\$225,000
Traffic Management	UNR-Intelligent Mobility	Regional Transportation Commission (Washoe County)	\$250,000
**Traffic Management	UNR-Intelligent Mobility	Nevada Department of Transportation	\$313,397
**Traffic Management	UNR-Intelligent Mobility	Regional Transportation Commission (Southern Nevada)	\$86,000
**Bioscience	UNR-DxDiscovery	National Institute of Health/ National Institute of Allergy and Infectious Diseases	\$595,000
**Bioscience	UNR-DxDiscovery	National Institute of Health/National Institute of Biomedical Imaging and Bioengineering	1,490,000
**Robotics	Autonomous Robots Lab	Defense Advanced Research Projects Agency	\$4,489,329
**Bioscience	UNR-Dx Discovery	Department of Defense	\$398,927
**Bio-Bubble/Community Health	UNR-Sc. Of Community Health	National Institute of Health NIDA/FDA Center for Tobacco Product	\$20,000
**Traffic Management	UNR-Intelligent Mobility	Regional Transportation Commission (Washoe County)	\$450,000
**Road Feature Extraction	UNR-Intelligent Mobility	Department of Transportation	\$328,819
**Autonomous Vehicles	UNR-Intelligent Mobility	Ozmen Center for Entrepreneurship	\$2,690
**Mining - Autonomous	UNR	Nevada Gold Mine	\$65,282
**Mining - Autonomous	UNR	Nevada Gold Mine	\$46,615
** Mining - Autonomous	UNR	Nevada Gold Mine	\$80,179
** Advanced Mobility	UNR-RTC	USDOT – Federal Transit Administration	\$195,392
** Critical Material	American Battery Metal Corp.	USDOE Advanced Manufacturing Office	\$4,500,000
** Batteries	American Battery Metal Corp.	US Advanced battery Consortium	\$2,000,000
* N/A			
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* Reporting period

** Previous periods



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Section II. G) EXPANSION OF THE SBIR/STTI MENORING PROGRAM

Accomplishments

The Sierra Accelerator for Growth and Entrepreneurship (SAGE) program supports community and economic development by providing SBIR/STTR grant support services to Nevada businesses, innovators, and entrepreneurs.

Program participation

During the program period, SAGE received 29 applications from 23 companies, of which 62% were from Northern Nevada, while 38% were from Southern Nevada. Women-owned businesses represented more than half of all program participants at 55%. A complete table of program participants and their industries can be found in **Table 2**.

Application progress

A total of eight applications are in progress for the current project period. Two applications have been submitted to two federal agencies - the Department of Transportation and the Department of Energy. Companies that are not actively developing proposals are currently seeking relevant funding opportunities to apply.

DEVELOPMENT OF WOLFCORPS

WolfCorps is designed to move research beyond the university laboratory and guide the process of transferring research innovations into products and processes that benefit society. Based on the Lean Launchpad methodology developed by Steve Blank, WolfCorps offers researchers an immersive training experience where participants engage with industry leaders to identify challenges and develop targeted solutions.

Program participation

WolfCorps was launched late in the project period and has just recently started receiving program applications. Currently, the program has four companies that have applied and will be attending the course. One company was accepted into the National I-Corps program and will be receiving a \$50,000 award for further company development.

In compliance with requirements for the Nevada Knowledge Fund grant, the following semi-annual updates relate to annual goals.

a. A statement of the benefit to the public from the distribution of the Knowledge

Account Grant funds, including documentation that supports the benefit; Nevada's strategic investment through the Knowledge Fund leverages the research, innovation, and entrepreneurial initiatives at the University of Nevada, Reno (UNR) to support economic development in the state. One national indicator of economic growth is the number of Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants awarded for each state. These grants are a key tool to help accelerate innovations at our universities and bring technologies *from lab to market*. The Sierra Accelerator for Growth and Entrepreneurship (SAGE) program provides tailored

support to innovators and entrepreneurs to improve their chances of receiving these grants. As a result of an entrepreneur securing a SBIR/STTR grant, the community may experience increased opportunities for employment, heightened business activity, and subsequent economic growth.

WolfCorps is designed to move research beyond the university laboratory and guide the process of transferring innovations to the marketplace that benefit society. Successful completion of this program strengthens a company's chance of successfully obtaining SBIR or STTR grants.

b. Information regarding the recruitment, hiring, operation and retention of research teams and faculty to conduct research in science and technology which has the potential to contribute to economic development in this State;

The objective of the program is to recruit faculty, students, small businesses, and community entrepreneurs to engage in technology-based innovation, both via the launch of new Nevada-based technology companies and to enhance technology innovation at the existing small-to-medium enterprises (SME) in Nevada. The SAGE and WolfCorps programs do not engage in personnel hiring and operations but instead support UNR faculty and members of the community to obtain grants and develop their business plans.

Information regarding research laboratories and related equipment located or to be located in this State;

Not applicable to SAGE or WolfCorps.

- *c.* Information regarding the construction of research clinics, institutes and facilities and related buildings located or to be located in this State; Not applicable to SAGE or WolfCorps.
 - d. Information regarding the research being conducted by the research teams and

faculty for which the Executive Director of GOED has provided funding pursuant to NRS 231.1597;

SAGE companies that have applied or are applying for grants fall under the following technology sectors or industries:

- Air Quality
- Agriculture
- Biotechnology
- Chemical Technology
- Consumer Products
- Cybersecurity
- EdTech/Training
- Transportation

- Healthcare
- Medical Devices
- Mining
- Renewable Energy
- Telecommunications
- Water Technology
- Space Technology

There is no industry data to report for WolfCorps, however, once the program is fully implemented, company industries will be consistent with technological areas emphasized by the National Science Foundation.

e. Information regarding the number of invention disclosures, provisional patent applications, and utility patent applications which have been filed, and the number of patents

which have been granted or issued, as a result of the programs established pursuant to NRS 231.1591 to 231.1597, inclusive;

Since the start of the funding period, SAGE has received 23 applicants engaged in new inventions and WolfCorps has received four. These are not invention disclosures tracked by the University. These are innovations for the launch of new businesses and/or new product lines for existing small businesses. Patents, if any, are considered company proprietary information and are not currently tracked under this program.

f. Information regarding the amount of research grants, gifts and donations awarded to the research teams and faculty recruited, hired, and retained pursuant to NRS 231.1597; SAGE assists companies with accessing two types of grants, Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants. The number of new SBIR/STTR awarded as a result of this program will not be available until late in 2022.

Participation in the WolfCorps program can lead to participants receiving an NSF I-Corps National Teams award (Team). One company will be receiving this \$50,000 grant for this project period.

a. Information regarding all grants, gifts, and donations to the Knowledge Account from public and private sources made through the Research Universities; Not Applicable

b. Information regarding matching funds for federal and private sector grants and contract opportunities that support economic development consistent with the State Plan for Economic Development developed by the Executive Director pursuant to subsection 2 of NRS 231.053;

Matching funds are not a metric applied to SBIR/STTR or NSF I-Corps grant programs. c. Information regarding the number of businesses that have been created or

expanded in this State, or relocated to this state, because of the programs established pursuant to NRS 231.1591 to NRS 231.1597, inclusive;

With SAGE and WolfCorps together, three new companies were incorporated in the State during the program period.

Information regarding the number of jobs which have been created or saved as a result of the activities undertaken pursuant to this Agreement; Information not collected.

d. Information regarding activities related to workforce development and training such as certificate programs and degree programs;

The program has conducted four events to provide information and SBIR/STTR training to Nevada businesses during the program period. However, SAGE is not a certificate or degree program.

e. For projects requiring a Financial Sustainability Plan, information regarding

progress toward attainment of sustainability; and

The Knowledge Fund has supported UNR as it builds competency and capacity toward a longer-term SBIR/STTR program. UNR plans to continue SAGE and WolfCorps services to faculty, University spinouts, and community entrepreneurs beyond the initial funding period.

For the SAGE program, UNR will apply for the Small Business Administration's (SBA) Federal and State Technology (FAST) Program in order to continue SAGE activities beyond the GOED project period.



Currently, 32 states are recipients of FAST funding and, if awarded, Nevada would join this innovation ecosystem receiving up to \$125,000 per year.

For WolfCorps, UNR plans to apply for the National Science Foundation's (NSF) I-Corps Hubs Program in order to continue WolfCorps activities beyond the GOED project period. If awarded, UNR would be part of the NSF's National Innovation Network and receive \$300,000 per year for five years.

f. All Commercialization Revenue, as defined in Section IV, received and the

allocation of such Revenue to the Inventor and the Research University as a result of the funded project.

Entrepreneurs and startup companies applying for SBIR/STTR and WolfCorps are early-stage. It's unlikely that there will be significant commercialization revenue by the end of the one-year program period as a result of an SBIR/STTR grant. Additionally, revenue generated from products and services sold by private companies is considered corporate proprietary financial information. We do not track this private information.

Company Name	Industry or Technology Sector	General Location
Advanced Regenerative Materials LLC	Agriculture/Environmental	Northern Nevada
Avanus Corporation	Consumer Products	Northern Nevada
Awareity	EdTech/Training	Southern Nevada
AWS Solutions LLC	Space Technology	Southern Nevada
Cargoclear Technologies	Cybersecurity	Southern Nevada
Champion Educational Services	EdTech/Training	Northern Nevada
Disruptor Scientific	Chemical Technology	Northern Nevada
Hook'd Wifi	Telecommunication	Southern Nevada
HorusEye AI LLC	Medical Devices	Southern Nevada
HydraCool LLC	Chemical Technology	Northern Nevada
Innovative Analysis	Healthcare	Northern Nevada
LiDAR Matrix	Transportation	Northern Nevada
N3Biotek	Medical Devices	Northern Nevada
New Vista Studios LLC	EdTech/Training	Southern Nevada
OLDEKG	Consumer Products	Northern Nevada
PURESITE INC	Air Quality	Northern Nevada
RazDevelop	EdTech/Training	Southern Nevada
Saatvik Advisors	Cybersecurity	Northern Nevada
SayleS LLC	Renewable Energy	Northern Nevada
ShapeShift Ciphers LLC	Cybersecurity	Northern Nevada
Sierra Circular Solutions	Mining	Northern Nevada
Solar Aqua Flex	Water Technology	Southern Nevada
Truckee Applied Genomics	Biotechnology	Northern Nevada

Table 2: Total Program Applicants



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Commercialization and Partnering Activities

N/A Programmatic and Project Changes

N/A

Looking Forward

To continue the program with the current successful outcomes.



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Section III: Performance

Tab	Table 3. COMPANIES AFFILIATED WITH NCAR: Start-ups/Spinouts/Established in ARF				
	Company Name	Core Specialty	Original Location	Jobs Created	Туре
1	Alert Wildfire System	IOT	Reno, NV	2	UNR Spin Out
2	American Battery Tech. Comp.	Lithium Batteries	Cambridge, MA	6	Established.
3	Atlas Magnetics	Spark Testing/	Reno, NV	4	Start-up
4	Avanus Corporation	Electronic Devices	Berkley, CA	1	Start-up
5	Disruptor Scientific	Nanomaterial	Reno, NV	1	Start-up
6	DxDiscovery	Biomedical	Reno, NV	10	UNR Spin Out
7	EpiSwitch Rx, Inc.	Biomedical	Reno, NV	4	Spin Out
8	Ethox Chemicals	Chemical Materials	South Carolina	2	Established
9	Eye Sight Quest, LLC	Optometry	Reno, NV	4	Spin Out
10	LF Research	Electromagnetic Tests	Poplar Grove, IL	2	Established
11	NV LED Optics, Inc.	LED manufacturing	Reno, NV	2	Start-up
12	Phigenics, Inc.	Biomedical	Warrenville, IL	8	Established
13	RosVivo Therapeutics	Biotechnologies	Reno, NV	3	Spin Out
14	Truckee Applied Genomics, LLC	Biotechnologies	Reno, NV	6	Spin Out
15	UVC Science, Inc.	UV Lights	Reno, NV	5	Start-up
16	*TuBiomics, Inc.	Biomedical	Reno, NV	3	Start-up
17	*Theralytix, LLC	Biomedical	Danville, CA	2	Start-up
18	*TLS Supply Chain Solution	Warehousing/ Freight	Turkey/Reno	9	Established
19	*Macoma Environmental Technologies, LLC	Photocatalytic system	Las Vegas, NV	5	Start-up
20	*LiDAR Matrix, Inc.	Sensors and Devices	Reno, NV	3	Spin Out
21	*DRW Consulting, LLC	Consulting/R&D	Carson City, NV	1	Start-up
22	*Bio-Med Scientific, LLC	Biomedical	Reno, NV	4	Established
23	*Carolina Cannabinoids	Нетр	Charlotte, NC	1	Start-up
				1	
	**Bioelectronica, Inc.	Biomedical	Palo Alto, CA	10	Alumni Company
	**Curative Technologies, LLC	Drug development	Reno, NV	3	Alumni Company
	**Flirtey	Drone Delivery Service	Australia	32	Alumni Company
	**Lana Sheta DBA FloCheck	Biotech	Reno, Nevada	1	Alumni Company
	**GenNext Materials & Technologies, LLC	NanoChemistry	Reno, Nevada	2	Alumni Company
	**Khepra, Inc.	Biotechnologies	San Diego, CA	4	Alumni Company
	**Kremenak Nanotech	Biomedical	Columbia, MO	3	Alumni Company
	**LactaLogic	Human Milk	Nevada/Florida	4	Alumni Company
	**Mission Support and Test Services	Operations at the NNSS	Multisite	1	Alumni Company
	**NexTech	Lithium Batteries	Berkeley, CA	9	Alumni Company
	**Oyster Point	Pharmaceutical	San Francisco, CA	1	Alumni Company
	**Presidio Medical, Inc.	Medical Devices	San Francisco, CA	9	Alumni Company
	**Prothelia, Inc.	Biotechnologies	Boston, MA	9	Alumni Company
	**rBio, Co.	Pharmaceutical	San Francisco, CA	1	Alumni Company
	**StrykaGen	Biomedical	Reno, NV	2	Alumni Company
	**Tarsus	Pharmaceutical	San Francisco, CA	8	Alumni Company
	**The Great Basin Institute	Environmental Res.	Reno, NV	3	Alumni Company
	* Added during this reporting period / ** Graduated out	of NCAR.	Total	190	



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Table 4. COMPANIES COLLABORATING: Remote collaboration on projects or initiatives				
	Company	Core Specialty	Location	
1	Proterra, Inc.	Electric Buses Manufacturing	California/North Carolina	
2	Nevada Automotive Test Center	Automotive Testing	Silver Spring, Nevada	
3	Fraunhofer IVI	Automotive / Transportation R&D	Dresden, Germany	
4	Regional Transportation	Public Transportation	Reno/Sparks	
	Commission - Washoe			
5	City of Reno	Municipality	Reno NV	
6	City of Sparks			
7	NV Department of	Transportation	Reno, NV	
	Transportation			
8	NV Department of Motor Vehicle	Transportation	Reno, NV	
9	City of Sparks	Municipality	Sparks, NV	
10	MSC Software Corporation	Simulations	Troy, MI	
11	Roboteam	Robotics	Israel	
12	Central European Institute of	Intelligent Mobility	Brno, Check Republic	
	Technology			
13	Dell EMC	Smart City Systems	Hopkinton, MA	
14	Switch	Data Center	Reno, NV	
15	Blyncsy, Inc	IOT	Salt Lake City, UT	
16	Velodyne	Sensors	San Jose, CA	
17	Truckee Meadows Water	Water	Reno, NV	
	Authority			
18	Northern Nevada Water	Water	Reno, NV	
	Planning Commission			
19	Truckee Meadows Water	Water	Reno, NV	
	Reclamation Facility			
20	Regional Transportation	Public Transportation		
	Commission – Southern Nevada			
21	City of Henderson	Municipality	Henderson, NV	
22	National Judicial College	Laws	Reno, NV	
23	Baidu	Artificial Intelligence	Begin, China	
24	Regional Public Safety Training	Driving Training/Testing Facility	Reno, NV	
25	Center			
25	SmartCone	Iransportation Safety / Fleet Management	Ottawa, Canada	
26	Nevada Innovation Center, LLC	Entrepreneurial/Business	Las Vegas, NV	
27	Important Safety Technologies	Artificial Intelligence – VRU App.	Berkeley, CA	
	USA, Inc.			
20	PIPD Foundation	Crants/Drograms/Collaborations	Tol Aviv / California	
28	DIND FOUNDATION	Grants/Programs/Collaborations		
30		Grants/Programs/Collaborations		
31	Nevada Gold Milnes	wining	EIKO, INV	



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Section IV: Metrics

Based upon achievements in the past two years, NCAR projects that the following targets will be met (it is expected that several targets will be exceeded):

Table 4. NCAR: KNOWLEDGE FUND SUMMARY ROLLUP - PROJECT:Income / Funds directly and indirectly related to NCAR activities

	This Period Nov 1, 2021 to Apr 30, 2022	Inception to Date Jan 1, 2016 to Apr 30, 2022
Fee for Service Agreements	\$118,654	\$1,844,813
Facility Use Agreements (including BEL / EL System)	\$187,185	\$888,357
Evolutionary Computing System Lab	-	\$140,510
Gifts / Donations (*)	-	\$4,965,572
Other Contributions (**)	-	\$1,200,000
Grants (***)	-	\$23,378,721
Total	\$305,839	\$32,417,973

(*)

Mick Hitchcock (Proteomics): \$1,200,000 / Mick Hitchcock (HPCF): \$200,000 / Switch (in-kind) in technology infrastructure support (space, power & security for 5 years): \$3,400,000 / Mick Hitchcock (Sterilization Room & Equipment in ARF): \$165,572

(**) Nevada Terawatt Facilities/NSTec: \$400,000 / UNR/VPRI (HPCF): \$800,000 (***) See Table 1 above for details



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Section V: Knowledge Fund Investment - Summary



Developing robotics, artificial intelligence and autonomous systems, with current research that includes:

- Drone and unmanned aerial operations, driverless cars, advanced manufacturing systems, underground and underwater robots.
- Nevada Gold/Barrick partnership testing underground robotics applications for exploration and safety.
- 42 patents filed by companies incubated in NCAR
- 670 Jobs created
- Commercialization revenue to University none, work in progress
- \$136.5M commercialization revenue (venture capital) to affiliated companies
- Development of large high-bay area to conduct
 University or industry drone tests with accuracy of position and orientation.
- Established testing safety procedures that have been validated through field trials since 2015.



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Intelligent Mobility

Developing solutions for safe, clean and efficient transportation. This statewide effort coordinated through NCAR involves:

- **Public and private stakeholders** including the Regional Transportation Commissions of Washoe County and Southern Nevada, cities of Reno and Henderson, Nevada Department of Transportation, The National Judicial College and Fraunhofer IVI, as well as businesses such as Switch, Proterra, Dell EMC and Velodyne Lidar.
- Researchers with expertise in synchronized transportation, advanced autonomous systems, computer sciences and robotics, geography, social psychology and judicial studies.
- "Living Laboratory" real-world test sites in Northern and Southern Nevada, with "lidar-enhanced" roads able to communicate data to connected vehicles.

Water Innovation Campus

Addressing water problems in Nevada through collaborations with the cities of Reno and Sparks, Truckee Meadows Water Authority, Western Regional Water Commission and Nevada Department of Transportation. Research includes water reclamation and reuse applications, stormwater management, industrial water and waste management and more.

Sierra Accelerator for Growth and Entrepreneurship (SAGE)

Initially launched in 2019, the statewide SAGE program expanded with Knowledge Fund support in 2020. SAGE is designed to put Nevada's qualified small, technology-based businesses on the path to earn federal grant funding through the competitive SBIR and STTR programs.

Making a Difference for Nevada

"NCAR was an attractive place for us to incubate and then scale. Most of our hires have been from the University. The proximity made it easy and they are talented employees. We want to be part of putting Reno on the map for biotech."

Jonathan Hull, co-founder of Bioelectronica which grew from 2 employees to 12 while based in NCAR

"The **collaboration with the University is an important step** in Flirtey's growth by allowing us to use their facilities and test Elitevs on campus. ... With its close proximity to Silicon Valley, budding tech scene and the state's strong aeronautical history, Reno is positioned to become the biggest little city in the world of UAV space."

Matt Sweeny, Flirtey, which grew from 2 to 30 employees, completed first-ever commercial drone delivery in U.S.

"(The Innevation Center) did more than help provide a location to meet people; it gave me like-minded people who are as crazy as I am to leave what you know to do something you believe in."

- Mark Ferguson, founder Lylius Innovation, which grew from 1 to 8 employees and plans to double in 2021

"The Nevada Center for Applied Research is charting a path to create the smart cities of the future by enabling multimodal communication between infrastructure, vehicles and people."

- Jon Barad, Vice President of Business Development, Velodyne Lidar, an Intelligent Mobility partner

"The **University is so important to the economy** and the future of our region that the business community has to be closely connected to it."

Mike Kazmierski, CEO, Economic Development Authority of Western Nevada (EDAWN)

For more information

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Section VI: Budget

Please see budget documents prepared by UNR Office of Sponsored Projects Administration.



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