Nevada Governor's Office of Economic Development

Knowledge Fund Proposal

Collaborative Industry-NSHE Unmanned Aircraft Systems Jump-Start Program

March 10, 2014

Contributions by

Lynn Fenstermaker
Associate Research Professor
Desert Research Institute
Lynn.Fenstermaker@dri.edu

Rama Venkat
Dean, Howard R. Hughes College of Engineering
Professor of Electrical and Computer Engineering
University of Nevada, Las Vegas
Rama.Venkat@unlv.edu

Kam K. Leang
Associate Professor of Mechanical Engineering
University of Nevada, Reno
kam@unr.edu

1 Project Summary

The goal of this collaborative project among NSHE research institutions, the Desert Research Institute (DRI), University of Nevada, Las Vegas (UNLV), and University of Nevada, Reno (UNR), is to advance industry-driven innovation-based economic development for unmanned aircraft systems (UAS) in Nevada. This goal will be achieved by creating a Jump-start Program that supports multiple competitive UAS projects (proposed by industry-NSHE teams) that have strong potential for commercialization and job creation in Nevada. The outcomes of the program include:

- Formation of partnerships between the private sector and NSHE to help grow UAS businesses already in Nevada;
- Attracting new UAS companies to move or open branch offices in Nevada;
- Enhancement of NSHE's UAS expertise, leading to national recognition;
- Testing and adaption of new platforms, sensors and applications methodology for commercial and governmental information needs;
- Increasing in UAS-related technology transfer opportunities, intellectual property, new companies, and potential patents and licenses.

The Jump-Start Program will work closely with the Nevada Institute for Autonomous Systems' (NIAS) Program Management Office (PMO) to solicit UAS projects from UAS industry, especially, the ones based in Nevada or planning to relocate in Nevada and NSHE teams (DRI, UNLV, UNR). Qualified external evaluators will review the proposals and make recommendations for funding. A team of five evaluators, which may include members of the Knowledge Fund Advisory Council, industry experts, and staff from NIAS and Nevada Industry Excellence, will evaluate the proposals according to established criteria. Each project will require at least *1-to-1 (industry-to-NSHE)* match. Even though industrial match is preferred, other sources of match are allowed.

Examples of UAS-related industry-NSHE projects include:

- Research: UAS design, sensor development, control systems, manufacturing, power systems, UAS software development, data analysis and visualization, data security, and communications, and GPS spoofing/jamming;
- Applications: UAS data acquisition and methods development for transportation, mining, entertainment, wildfire monitoring, cloud seeding, utility corridors, energy development, aerosol/cloud physics research, archaeological mapping and monitoring, ecosystem health, water quantity and quality, agriculture and land use planning and development, etc.; and
- Training and Certification: Develop educational infrastructure to qualify a workforce that is able to address the various needs of the UAS industry including pilot training and maintenance operations.

2 Introduction: UAS in Nevada and Nevada's Assets

On Monday, December 30, 2013, the Federal Aviation Administration (FAA) announced that Nevada was chosen as one of six test sites to begin work on safely integrating UAS into the National Airspace System (NAS). The announcement states "Nevada will focus on developing UAS and operator standards and operations. Operator certification requirements will be considered also. Additionally, the state will develop air traffic control procedures for UAS presence in the NAS. Geographic and climatic diversity effects on UAS will be considered".

The FAA Modernization and Reform Act of 2012 is driving the integration of UAS into the NAS by September 30, 2015. Similar efforts exist in Europe and other countries worldwide. For Nevada, several economic reports predict thousands of high-paying UAS-related jobs, as well as $2.5 billion in economic impact -- and $125 million in state and local tax revenue. [Source: Economic Modeling Specialist Intl. ("EMSI"), Association for Unmanned Vehicle Systems Intl. ("AVUSI").]

The national interest in UAS has spawned a renaissance in the UAS industry as manufacturers extend their vision beyond the military market to national and international commercial applications including a wide variety of new platforms and sensor technologies. UAS are already beginning to enter the civilian market in support of agriculture, mining exploration, environmental monitoring, fire-fighting in urban and remote areas, crime fighting, roadway traffic monitoring, cloud seeding, and many other applications. This expanded use will increase the demand for optimized platforms and sensors ensuring performance, safety and security, which require: trained pilots, mechanics, and engineers; workers trained in UAS manufacturing; sensor developers and operators; and applied research and development capabilities. These new developments in the UAS industry renaissance have enormous technology based economic potential for the State of Nevada.

The State of Nevada has and will continue to fully support research and business activities in UAS [1]. Nevada is home to many valuable UAS assets and the state has a long history dating back to World War II in research, design, development and application for a variety of defense technologies and applications. In fact, Nevada is the birthplace of the unmanned aerial vehicle (UAV) industry and the first state to integrate the National Guard into the UAV program. Nevada has more Department of Defense UAS pilots than any other state [1].

Nevada's airspace is unique, with its expansive Military Operations Areas (MOAs) for testing, and general aviation airspace ranges from extremely low density (both aircraft and population) to extremely high density in certain areas. Additionally, Nevada is home to a number of other critical assets that support UAS such as:

- Nellis Air Force Base, Creech Air Force Base, Naval Air Station Fallon and the Hawthorne Army Depot [1]. Nellis is the access point to the Nevada Test and Training Range, which has the largest contiguous ground/air space for military flight training, i.e., 5000 square miles of restricted air space.

- Creech Air Force Base, about 35 miles north of Las Vegas, is home to the 432nd Wing, which has six operational squadrons, one maintenance squadron, and MQ-9 Reapers and MQ-1 Predator UAVs. The base is also home to the UAV Battlelab.
- Naval Air Station Fallon is the U.S. Navy's premier air-to-air and air-to-ground training facility.
- Nevada ranges include the restricted airspace of the Nevada National Security Site (NNSS) operated by the Department of Energy's National Nuclear Security Administration (NNSA).
- A large number of small community-based airports scattered across Nevada, which include the Reno-Stead and Boulder City Airports listed in the Nevada proposal to the FAA.

2.1 UAS-Related Industries in Nevada and Potential Partnerships with NSHE

Nevada is home to many UAS-related industries, many of which are eager to partner with NSHE faculty and researchers with the goal of developing more competitive and better technologies and expanding their companies.

For example, Drone America, located in Reno, manufactures and delivers amphibian and land UAS for humanitarian, civil, and military applications. Sierra Nevada Corporation (SNC), with headquarters in Sparks, Nevada, focuses on electronics and systems integration. SNC is world renowned for its rapid, innovative, and agile technology solutions. The fast-growing and widely diversified company is a high-tech electronics, engineering, and manufacturing corporation that continues to expand its impressive portfolio of capabilities, programs, products and services. Other industry leaders in UAS are already located in the state, including Lockheed Martin, General Atomics, Arcata Associates, and Northrop Grumman. In addition NSHE has been in communication and providing information to help establish a company office for Sensurion in Las Vegas and a Reno office for CCLD Technologies, Inc. Table 1 provides a brief list of potential industry partners for R&D collaboration with NSHE faculty and researchers.

Table 1. An example list of potential industry partners for R&D collaboration with NSHE. This is a representative list of companies from a list of over 400 companies provided by Nevada Industry Excellence (NVIE). "X" indicates who will take the lead in connecting with the company.

Location/Company	NVIE	DRI/UNR/UNLV
Reno/Sparks based Companies: Abaris, Aerion Corp., Arrow Electronics, Avnet, Bally Technologies, Digital Solid State Propulsion, Drone America, Future Electronics, Hamilton Company, IGT, Lux Dynamics, Nevada NanoTech Systems, Inc., Pinyon Technologies, Reno A&E, SpecTIR, Sierra Nevada Corp, Server Technology, Tripp Enterprises	X	X
Carson City/Minden based Companies: All Metals Processing Company, Cubix, GE, HawlTech, Metrix Instrument Co., Click Bond, Inc., Hytech Microsystems, Inc., Sierra Control Systems, Inc., Western Servo Design, Zephyr Photonics	X	X
Elko/Fallon/Fernley based Companies: SAS Global Inc., CBA Electronics Inc., AGRU America, EITEL MANUFACTURING	X	
Las Vegas/Boulder City/Henderson based Companies: NSTec, SWITCH, Adhesive Manufacturing Inc., VEKA West Inc., Jones Machine Company, VADATECH Inc., V.S.R. Industries, FCI Environmental, Las Vegas Global Economic Alliance (LVGEA), Arcata Associates, Science Application International Corporation (SAIC)	X	X
Out-of-State Companies: Insitu (Bingen, WA), Dassault/Falcon (San Jose, CA), Boeing (Seattle, WA), Matrix Group		X

2.2 Collaboration with Nevada Industry Excellence (NVIE)

Nevada Industry Excellence (NVIE) is an Industrial Extension Program of the Nevada System of Higher Education and has been in existence since 1995. Its mission is to help Nevada manufacturers, mines, and construction organizations transform the way they do business and become more competitive in the markets they serve. NVIE is primarily funded by federal grants through the Department of Commerce, and through private client fees but also receives a small amount of state funding. Nevada Industry Excellence maintains regular access to Nevada's Manufacturing industry throughout the state.

Nevada Industry Excellence serves the entire State of Nevada from offices located in three regions: Carson City, Reno, and Las Vegas. All NVIE offices are located on NSHE campuses, including Truckee Meadows Community College, University of Nevada, Reno, University of Nevada, Las Vegas, Western Nevada College and System Administration South. NVIE provides services to the Eastern part of the state through the Northern Nevada regional team located in the Reno/Carson City area.

DRI, UNLV and UNR intend to engage NVIE's current client base of manufacturers throughout the state via its nine field project managers who are regularly working with manufacturers to help recruit companies to partner with NSHE. These project managers are responsible for business development, project financial bookings through a formal sales and engagement process, defining and preparing proposals, contracting, managing projects and supporting a

third party survey process to capture impacts. Additionally, NSHE will work closely with NVIE to help identify industry-driven needs and projects.

2.3 Example Industry-NSHE UAS-Related Projects and Applications

Examples of industry-NSHE UAS-related projects and market areas include the following.

- Search and rescue technologies,
- Landscape Imaging in 3-D for Mining and other Applications,
- Land Management and Wildlife Protection
- UAVs for Ranching and Agriculture:
- Storm Monitoring
- Utility corridors and energy development.
- Aerosol/cloud physics research:
- Wildfire:
- Cloud Seeding
- Mining
- Land Use Planning and Development
- Water Quality and Aquatic Health

2.4 UAS Expertise at NSHE Institutions

At DRI

DRI faculty across the three disciplinary divisions (atmospheric sciences - DAS, hydrological sciences - DHS, and earth and ecosystems sciences - DEES) are either currently engaged in UAS-related research or have strong interests in expanding their research to UAS. For decades DRI has been using manned aircraft and balloons to conduct various research (cloud physics, cloud seeding, hyperspectral data acquisition) and initiated UAS specific research in 2005 with a multispectral helicopter platform. The primary areas of DRI interest in UAS research include:

- Sensor Development: Sensors designed and fabricated for manned aircraft are being downsized for deployment on UAS. Some of these sensors include: a T-probe that measures water particles in clouds (solid, liquid and total); photoacoustic sensors that identify air pollution plumes; sensor packages to measure solid particulates (PM10, PM2.5) and air pollutants; and reducing the size of cloud seeding generators for UAS deployment (J. Watson, J. Chow, R. Purcell, H. Moosmuller, J. Tilley, P. Arnott DRI/UNR).
- Data Analytics, Visualization and GIS: (C. Collins, T. Jackman, J. Mahsman)
- UAS Applications:
    - Agriculture, irrigation scheduling, evapotranspiration: (J. Huntington, L. Fenstermaker, K. McGwire)
    - Air pollution: (J. Chow, J. Watson, X. Wang, E. Wilcox)
    - Archaeological mapping and monitoring: (J. Baker, P. Buck, S. Edwards, D. Rhode, D. Sabol)

- Aquatic plankton and algal monitoring: (C. Fritsen, J. Memmott)
- Atmospheric modeling and validation: (M. Kaplan, E. Wilcox)
- Climate and remote sensing: (D. Lowenthal, I. McCubbin)
- Climate modeling and response: (J. Mejia, E. Wilcox)
- Cloud physics: (J. Tilley, R. Purcell, E. Wilcox)
- Cloud seeding: (J. Tilley)
- Dune formation: (N. Lancaster)
- Dust emission and prediction: (V. Etyemezian, E. McDonald, G. Nikolich)
- Ecosystems monitoring, climate change, carbon cycling: (X. Wang, J. Arnone, L. Fenstermaker, K. McGwire)
- Erosion, flood monitoring, stream channels: (J. Miller)
- Exobiology: (H. Sun)
- Groundwater pumping subsidence mapping and related issues: (S. Mizell, C. Russell)
- LiDAR, SAR, InSAR and similar sensors: (H. Moosmuller, R. Schumer, C. Russell)
- Hydrological modeling: (D. Decker, L. Chen)
- Mining: (J. Memmott, T. Minor, D. Sabol)
- Riparian systems: (K. Acharya)
- Sediment transport: (J. Miller, R. Schumer)
- Soil contamination: (E. McDonald)
- Soils, geomorphology: (E. McDonald)
- Soil moisture/physics: (M. Berli, L. Fenstermaker)
- Springs: (D. Sada)
- Thermal and hyperspectral application: (M. Cablk, L. Fenstermaker, C. Fritsen, K. McGwire, J. Memmott, T. Minor, D. Sabol)
- UAS water sampling: (C. Fritsen, J. Memmott)
- Water quality: (K. Acharya, J. Chapman, D. Decker, A. Heyvaert, J. Thomas)
- Wildfire: (K. McGwire, A. Watts)
- Wildlife monitoring: (J. Brock, M. Cablk)
- Wind energy assessment: (J. Robles, C. Smith)

At UNLV

UNLV faculty members are active in UAS R&D, such as unmanned aerial vehicle (UAV) design and control, communication, controls, sensor development, path planning, and security. Funding agencies include the U.S. Air Force Research Laboratory (AFRL), Sandia National Laboratories (SNL), and private industries. The following are examples of recent research by our faculty.

- UAS Design:
  - Design of UAV with foldable composite wings (B. O'Toole)
  - Novel designs of miniature flapping wing UAV (M. Trabia, W. Yim)
  - Adaptation of a JP-8 fueled engine to a commercial UAV (W. Culbreth)
  - UAV flow control devices using smart materials (K. Kim, W.Yim)
  - Design of UAS for indoor hazardous environments (W. Yim)
  - Advanced material research to develop new UAV materials for airframes and potential smart material sensing applications (K. Kim, K. Sun)

- UAS Control Systems:
  - UAV Control (S. Singh, P. Kachroo, W. Yim, M. Trabia)
  - Autonomous flight (S. Singh, W. Yim)
  - Cooperative, multiple UAVs: trajectory planning, control, and communication (S. Singh, W. Yim)
  - Design of concurrent control software for cooperating UAVs (S. Singh)
  - Control and motion planning algorithms for indoor UAVs (W. Yim)
  - Fault tolerant control (S. Singh)
  - Non-GPS navigation (S. Singh, V. Muthukumar)

- UAS Communications Systems
  - Wireless, secure communications for UAS-to-UAS and UAS-to-ground (Y. Kim, J. Jo)
  - A hierarchical communication architecture for secure non-LOS communication in a UAV fleet without GPS links (Y. Kim, J. Jo)
  - Advanced circuits and system design for robust wireless communication (J. Baker)
  - Ubiquitous monitoring and sensor network using autonomous UAVs (Y. Jiang)
  - Asymmetric On-board Encryption Algorithms for Communications (Y. Kim, J. Jo)
  - Compact antenna development (R. Schill)
  - Camouflaged Communication using plasma antenna to generate a narrow bandwidth signal in a large bandwidth of noise with low signal-to-noise ratio to communicate with UAS with minimal awareness to eavesdroppers (R. Schill)
  - Avoidance of signal jamming for UAS applications (R. Schill)

- UAS Sensor Development
  - The objective of this area is to develop miniature, lightweight sensors for airborne chemical, biological, or nuclear threats that may be networked in a multi-sensor "mesh" for UAV applications. Potential applications include national security applications, monitoring of illegal drug manufacturing operations, pollution and other environmental monitoring, vegetation and water content

measurement, and residential/industrial energy efficiency assessment. (A. Barzilov, T. Porter, Y. Jiang, M. Yang)

- Power Systems
  - Wireless Power Transmission, in-flight battery recharging (Y. Baghzouz)
  - Development of a solar-powered UAV (D. Pepper)

- Automatic System Operations Monitoring
  - Intelligence UAS system health monitoring (S. Latifi)
  - Modeling and In-Flight Testing (W. Yim, M. Trabia)
  - Simulator and sub-system testing laboratory (W. Culbreth, V. Muthukumar)
  - Testing UAVs under harsh conditions such as over a fire, storm, rain, abnormal winds etc. (W. Culbreth)

- UAS Computational Platforms
  - Development of a high-performance, low-energy consumption, reconfigurable computing platform and software architecture for cooperative UAVs (A. Stefik, Y. Kim, J. Jo)

- Intelligent System Health Monitoring Research

The ability of a UAV system to reliably identify failures and classify them according to their impact on vehicle safety and mission success is a key technology for flying UAVs with an acceptable level of safety. Identification of sub-systems as they deteriorate will focus maintenance efforts, decreasing the turn-around times between missions and reducing costs per flight hour

At UNR

At the University of Nevada, Reno, the colleges with interest in UAS are the College of Engineering (CoEN), College of Agriculture, Biotechnology and Natural Resources (CABNR), College of Science (CoS), College of Cooperative Extension (CoCE), and the College of Business Administration (CoBA). Currently, over 20 faculty members from these colleges have expressed interest in UAS work:

- Sense and Avoid: (G. Bebis, S. Fadali, J. Henson, K. Leang, S. Louis, Y. Shen)
  - Novel approaches to navigation through tight urban environments. GPS-denied sensing schemes for localization and avoidance that include radar systems, fiber optics and optic flow technologies, acoustics, and magnetics.

- Command, Control and Communication Systems: (I. Chatterjee, S. Fadali, J. Henson, K. Leang, S. Louis, Y. Shen)
  - Design of sensing and control systems for high performance energy efficient

autonomous micro unmanned air vehicles for surveillance, disaster search and rescue operations, and remote sensing and mapping.

- Dedicated Radio-Frequency Spectrum, GPS Jamming and Spoofing: (I. Chatterjee, S. Sengupta)
  - Antenna design and modeling that can be applied to the design of dedicated radio-frequency spectrum systems for UAS
  - Antenna design and modeling that can be applied to global positioning system (GPS) jamming and spoofing work.

- Human Factors: (M. Nicolescu, D. Feil-Seifer)
  - Developing methodologies for successfully integrating autonomous systems into human society

- Applications of UAS: (M. Walker, S. Tyler, G. Kent, S. Wesnousky)
  - Environmental science, natural resources, and land management, including a broad range of disciplines, many of which rely upon piloted, sub-orbital aircraft and spacecraft.
  - Low level-LIDAR (light detection and ranging) surveys, mapping, and monitoring using extensive wireless sensing networks and distributed fiber optic sensing technologies.
  - Use of UAS for wildfire detection, wildfire fuel management and hazard assessment, managing habitat for endangered species conservation, constructing high spatial and temporal resolution 3-D imagery, earth surface temperature monitoring, storm tracking, and wildlife conservation.

3 The UAS Jump-Start Program

3.1 Overview

Funds will be used to support multiple collaborative industry-NSHE projects. Each project must involve NSHE faculty, the NIAS PMO, and an industry partner working on a relatively mature technology or innovative concept that has potential for commercialization. Industry collaborators must provide matching funds (minimum 1:1, but 2:1 preferred). Cash matching from other sources will be considered. Priority will be given to projects with:

- strong potential for commercialization
- strong potential for tech transfer, IP and potential patents and licensing
- prototype development
- strong business plan; collaboration with UNLV or UNR Business College will be a plus.

Other criteria for evaluation will include:

- Coordination and collaboration with the NIAS PMO will provide NSHE faculty with enhanced access to a larger industry base and ensure that projects will align with FAA Test Site policies; e.g., to ensure proposals will not include efforts that would be prohibited by FAA UAS guidelines.
- Employment of lean start-up approach emphasizing pairing "customer development" with "product development."

3.2 Proposed Budget and Timeline

The requested $500K Knowledge Fund will support three projects (one per institution) over a three-year project period. Project proposal funding requests will be between $100-170K each. Two funding cycles are proposed: Round 1 and Round 2 as shown in the timeline in Table 2. Project reporting to GOED will occur as needed, for example at four or six month intervals. The progress and outcomes of each funded project will be reported to GOED.

Table 2. Project timeline

	Year 1	Year 2		Year 3	
Tasks	(6 mons.)	(6 mons.)	(6 mons.)	(6 mons.)	(6 mons.)
Round 1: Announce RFP	x				
Round 1: Fund Project(s)		x			
Round 2: Announce RFP		x			
Round 2: Fund Project(s)			x		
Report to GOED	x	x	x	x	x

3.3 Proposal Format

Each proposal must include the following:

- Executive Summary of proposed project (limit 1 page)
- Proposal body (limit 5 pages maximum; 12 pt font), which should include (but is not limited to) the following sections:
  - Goals of the project
  - Tasks and business plan to meet project goals
  - Roles of NSHE faculty and industry partner(s)
  - Timeline and budget (summary of major budget categories in the proposal body and detailed budget in an appendix
  - Expected benefits and statements about the short- and long-term impacts of the project.
  - Number of patents to be filed
  - Number and Amount of SBIR and STTR proposals developed and submitted as a result of this funding.
  - Number of businesses that will be created or expanded in Nevada
  - Number of jobs created or saved as a result of the project activities.
  - Other potential metrics include: number of students trained and/or participating

in industry internship programs.

- Each project will require a minimum of 1-to-1 (industry-to-NSHE) match. Higher match is encouraged. A letter of match commitment from the industry partner and other sources should be attached.
- Appendices (no page limit and not included in the page count for the proposal body) should include: references, detailed budget, and any other background information important to the proposal effort.

3.4 Proposal Evaluation Process

Each proposal will be reviewed by a team of five external evaluators, potentially including members of the Knowledge Fund Advisory Council, industry and business experts, and staff from the Nevada Institute for Autonomous Systems and Nevada Industry Excellence. The reviewers will evaluate the proposals based on merit (40%), potential for economic development (technology transfer, IP generation) (40%), the qualification of the team members to perform the tasks (10%), and whether they meet the goals of GOED (10%). Evaluators will score the projects individually and then work as a team to make the final decision. Decisions will be announced within one month of submission. An example of the scoring sheet is attached in Appendix A.

4 Market and Economic Impact

To enhance the diversity of the state's economy, UAS industry should be encouraged to move to Nevada. Additionally, the business environment of the state should foster start-ups. It has been proven repeatedly that a knowledgeable workforce is an important component of what is needed to meet these two goals. The proposed UAS industry-NSHE Jump-start Program will focus on these issues, as mentioned earlier.

As illustrated in Table 3, the economic impact of a UAS industry in Nevada for years 2011 to 2022 will potentially more than quadruple. These numbers indicate that the UAS industry is poised to become a major component of the Nevada economy. However, this will not happen unless the institutions of higher education in Nevada – as well as the state agencies – coordinate their efforts to foster the UAS industry by first attracting them to Nevada and providing them with the intellectual capital and the needed workforce. This proposal will aid in achieving both these essential goals.

Manufacturing activities associated with UAS industry testing and development has the potential to become one of the most economically critical components of the industry in Nevada. An overview and forecast for Nevada and its two regions are listed in Table 4.
This proposal is designed to "Jump-Start" UAS economic growth in NV and help ensure realization of the numbers projected in Tables 3 and 4 by fostering industry-NSHE collaborations that in turn will help provide student training, education, R&D, and further industry outreach.

This effort will also bring recognition to NV as a leading state in UAS which will attract an educated workforce to Nevada.

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Table 3. Total Nevada UAS industry economic impacts, data from Economic Modeling Specialist Intl. (EMSI), Association for Unmanned Vehicle Systems Intl. (AVUSI).

Year	Nominal	3% Present Value Discount	7% Present Value Discount
2011	$2,567,094,653	$2,567,094,653	$2,567,094,653
2012	$2,611,672,836	$2,535,604,695	$2,440,815,735
2013	$2,646,762,490	$2,494,827,496	$2,311,784,864
2014	$2,683,642,433	$2,455,912,989	$2,190,651,620
2015	$2,721,775,578	$2,418,262,348	$2,076,429,557
2016	$5,482,400,416	$4,729,166,758	$3,908,875,727
2017	$8,305,729,968	$6,955,918,089	$5,534,458,577
2018	$8,794,781,495	$7,150,962,178	$5,476,947,906
2019	$9,318,068,209	$7,355,769,090	$5,423,200,535
2020	$9,878,087,616	$7,570,731,633	$5,373,025,167
2021	$10,476,901,815	$7,795,798,888	$5,325,925,621
2022	$11,115,997,977	$8,030,433,449	$5,281,130,563

Table 4. Nevada UAS manufacturing overview and forecast, data from Economic Modeling Specialist Intl. (EMSI), Association for Unmanned Vehicle Systems Intl. (AVUSI).

Indicator	Nevada	Northern Region	Southern Region
Establishments (2012)	32	23	7
Jobs Multiplier	2.05	2.05	1.64
Gender:			
Male	75%	73%	83%
Female	25%	27%	17%
Age:			
14-18	1%	1%	3%
19-24	8%	6%	13%
25-44	43%	42%	45%
45-64	44%	48%	35%
65+	4%	4%	5%
Jobs:			
2002 Jobs	1,061	879	182
2012 Jobs	1,321	968	351
% Change (2002-2012)	24.5%	10.2%	92.8%
2018 Jobs	1,400	987	411
% Change (2012-2018)	6.0%	2.0%	17.1%
Average Earnings Per Job (2012)	$62,401	$67,563	$48,280

4.1 Expected Economic Outcomes of this Project

The following are the expected outcomes:

- Two year expenditure from the funded projects will be $1,000,000 at a minimum.
- All these projects will have at least one industry partner who provides matching funds. Since all projects funded here will have an industry sponsor, we can expect the 3 to 6 disclosures and 3 licenses at the very least.
- In addition, since the business schools are involved in the Business plan part of the proposal, at least two start-ups can be expected.
- In addition, these projects will involve a minimum of ten undergraduate and graduate students, who will be well-prepared to work in the UAS industry locally.

The primary goal of the projects is to enhance economic growth in Nevada. The following are the metrics from the Knowledge Fund legislation (AB 449) for which each project should strive to meet one or more:

- Number of jobs created or saved (including faculty hires)
- Number of businesses created or expanded within Nevada
- Amount of grants awarded as a result of the project
- Research laboratories and related equipment located in Nevada
- Infrastructure constructed within Nevada resulting from the project
- Assistance to Nevada businesses and NSHE in developing commercial applications
- Technology transfer from NSHE to Nevada entrepreneurs, businesses, and state and community colleges
- Connect market ideas in new or existing Nevada businesses

Appendix A: Scoring Sheet

Technical Merit

Strengths:

Weaknesses:

Score: (max: 40)

Potential for Economic Development

Strengths:

Weaknesses:

Score: (max: 40)

Qualification of the Investigators

Strengths:

Weaknesses:

Score: (max: 10)

Meeting GOED Goals

Strengths:

Weaknesses:

Score: (max: 10)

Total Score: (max: 100)