



University of Nevada, Reno

# **The Nevada Advanced Autonomous Systems Innovation Center at UNR**

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## Quarterly Progress Report

Reporting Period: July 1<sup>st</sup> to September 30<sup>th</sup>, 2015

October 2015

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## Project Purpose

The early 21<sup>st</sup> century has been characterized by an explosive growth in the number of autonomous systems in use around the world. These systems – unmanned vehicles, disaster response robots, drones, and others – have created the potential to revolutionize the way that we live and work. However, these systems have also proven extraordinarily difficult to develop and deploy, much less do so profitably. The mission of the Nevada Advanced Autonomous Systems Innovation Center, or NAASIC, is to solve the complex problems surrounding the development, application, and commercialization of autonomous systems through unique industry-university partnerships, innovation, cooperative research, and entrepreneurship. Ultimately, the goal is to spur research and commercialization to advance innovation-based economic development in Nevada.



Faculty at the University of Nevada, Reno have long studied the problems surrounding autonomous systems. Publications by UNR researchers in fields such as robotics and artificial intelligence have been read and cited all over the world for many years. However, recognizing the growing commercial potential of autonomous systems, the vision of NAASIC is that the Center will be able to leverage the strengths of UNR faculty to become a national and global leader in commercially-focused technology innovation in advanced autonomous systems.

Although the field of Autonomous Systems is large and varied, NAASIC's current focus is on unmanned aircraft systems, or UAS. In contrast with more nascent areas of autonomous systems, such as self-driving vehicles or service robots, the commercial market for UAS is large and expanding. Additionally, the Federal Aviation Administration (FAA) has chosen the State of Nevada as one of its six UAS Test Sites. The mission of the test sites is to assist the FAA in safely integrating unmanned aircraft into the United States' National Airspace System (NAS). In support of this mission, NAASIC is working to find commercially-relevant uses for UAS, and is assisting the State in its mission to the FAA. The expectation is that this early work to integrate UAS into the NAS will enable ongoing and future commercialization efforts, described below.

## Section I: Proposal Progress

During the reporting quarter, NAASIC has made significant progress toward the goals listed above. In the present reporting period, the overarching goals were to finalize several agreements with the National Aeronautics and Space Administration (NASA), to establish procedures under which UNR can operate its aircraft under the State's FAA certificate of authorization (or COA), and to begin integrating new hires into NAASIC research and development. All three of these goals have been met with resounding success, leading to tangible and measurable results for both the State of Nevada and UNR.

Major accomplishments for the current reporting period include:

### **1. NAASIC Participation in NASA's UTM Project.**

Researchers at NASA Ames Research Center are currently developing a prototype system for unmanned aircraft systems traffic management. This system, known as UTM, is being developed by NASA to allow UAS to interface with an air traffic control system so that they can operate safely in the National Airspace System. Because of the expected volume of UAS traffic, the UTM system is being designed with autonomy in mind.

NAASIC has been working with NASA on the development of this system for several months. In September 2015 this work finally led to NAASIC's flying with NASA and Flirtey, Inc. at the NASA Crow's Landing Airport in California for what NASA called "UTM Build 1." The flights conducted by NAASIC and Flirtey were highly successful, and helped to solidify NAASIC's relationship with NASA. NAASIC was one of just 12 organizations in the country to assist NASA in Build 1, and Nevada (through NAASIC) was one of just two FAA test sites to successfully fly in Build 1.



## 2. NAASIC Support of the Nevada Cooperative Research and Development Agreement with NASA.

Through NAASIC, UNR has partnered with the State of Nevada and the Reno-Tahoe Airport authority to enable Nevada's continued support of the NASA UTM project described in the previous item. As a result of a proposal put forward by GOED with the support of UNR and RTAA, the State of Nevada was awarded NASA Cooperative Agreement NNX15AV03A, a **\$1,247,703.80** five-year grant to the State to support NASA's development of the UTM system. The portion of this grant expected to go to UNR is approximately \$250,000 over the five years of the grant. This will allow NAASIC to support the State's technical work with NASA on UTM.

## 3. NAASIC Support of Nevada's Test Site Partnership with NASA.

Through NAASIC, the University of Nevada, Reno was a part of the Nevada team led by GOED that was awarded approximately **\$150,000** to complete a Task Order (TO1) to develop UTM software, as well as approximately **\$337,000** to complete a Task Order (TO2) to develop a connection to an airspace management simulation platform housed at NASA Ames Research Center. The portion of these awards expected to go to NAASIC is approximately \$130,000 over the next year.

Additionally, NAASIC is working with the State and RTAA to open a research lab at Stead Airport. This lab (The NUANCE lab) is projected to become a centerpiece of UNR's airspace management research, in addition to housing the State's connection to NASA's airspace simulation system.

## 4. Additional Accomplishments

### a. *Test flights conducted by NAASIC under the State COA.*

In addition to flying under NASA's authorization, in September NAASIC successfully flew under the Nevada Test Site's COA in partnership with the Nevada Institute for Autonomous Systems (NIAS). As a result of successful operations with NIAS, NAASIC's business director Warren Rapp has been delegated authority to oversee flights under the Nevada Test Site COA.

### b. *UAS Cluster Hires*

On July 1, the College of Engineering welcomed three new faculty members with tremendous expertise in unmanned aircraft systems. These faculty members (in Mechanical Engineering, Electrical Engineering, and Computer Science and Engineering) are currently working with NAASIC to write grant proposals, the first of which should be going out in the final quarter of this calendar year.

Additionally, NAASIC is finalizing the paperwork to hire one postdoctoral researcher in support of these new faculty members. This postdoc will split his time evenly between NAASIC development and a research program to be developed in partnership with the UAS faculty.



Lastly, NAASIC has filled its grant writer position, who has started working with the thrust area leaders, the UAV cluster hires, and NAASIC staff to write proposals.

*c. International Scientific Operations*

Supported by funding from Rutgers University and the UNR College of Science, NAASIC Business Development Director and experienced pilot Warren Rapp joined a team of researchers in Mongolia to conduct river ecology studies, focusing on endangered trout in Mongolian rivers. This included a field workshop and technology demonstrations for the international research team as well as the local population.

*d. Outreach at the 2015 National Championship Air Races*

At the 2015 National Championship Air Races at Stead Airport, NAASIC helped sponsor the “Drone Zone,” which introduced a large number of local students to unmanned aircraft and autonomous systems.

## **5. Commercialization & Partnering**

NAASIC is currently working with UNR Computer Science professor Jim La to commercialize his work on bridge inspection robots. To this end, NAASIC engineer Richard Kelley is working as senior personnel on a \$200,000 grant that La has submitted to turn his bridge-inspecting robot into a commercial product.

NAASIC is also working with a number of local and national companies. Details may be found in Appendix 1, but briefly those companies with which NAASIC established or extended its relationship in this quarter are: Cloud Cap, Koch Industries, Flight Research Associates, GC2IT, the Reno-Tahoe Airport Authority, and Airware.

## **6. Programmatic & Project Changes**

Material changes to the NAASIC project took the form of a budget modification that was executed in the period immediately prior to the present reporting period. The modifications were relayed to Center leadership at the beginning of the present reporting period. Budget modifications were made for, among other reasons, addressing the differences between budget allocations projected for year one of the project and actual money committed during the first year of the grant. For additional details on these differences, refer to the *NAASIC Expenditures* table in Section III of the present report. Further modifications of this nature are not anticipated as being necessary.

## **7. Looking Forward**

Looking ahead, NAASIC plans to continue exploring both commercial and academic opportunities. In the commercial space, NAASIC plans to use the authority it has received under the FAA test site to expand test flights under NAASIC supervision. The provision of data analysis and post-flight support could provide revenue streams in the near future. As the NUANCE Lab is established and



connected to NASA's systems, that connection also represents a possible monetization opportunity. Lastly, NAASIC plans to more aggressively pursue a commercialization plan for faculty research.

In a more academic direction, the UAS Cluster Hires in the College of Engineering are working closely with NAASIC. In addition to their efforts, NAASIC is working to direct the efforts of its thrust area leaders to produce more tangible results for NAASIC. The Center is also in the process of finalizing an offer to a Technical Director candidate.



## Section II: Performance

Table 2. Progress toward Metrics

Standard Knowledge Fund Metrics	Current Status / Target		
	By 04/28/15	By 04/28/16	By 04/28/17
Companies moved to Nevada	1 / 1	1 / 3	1 / 5
Startup companies	0 / 0	0 / 1	0 / 3
Jobs created	2 / 10	9 / 32	2 / 36
Intellectual Property Licenses/Options Executed	0 / 0	0 / 1	0 / 3
Intellectual Property Revenue	0 / 0	0 / 0	0 / \$100k
Grants Received	\$200k / \$200k	\$380 / \$500k	0 / \$1M
Sponsored Research	0 / 0	0 / 0	0 / 0
Patents	0 / 0	1 / 1	1 / 3
Students placed with Companies	1 / 1	4 / 5	0 / 8
Impact Faculty Hired	1 / 1	4 / 2	4 / 2
Gifts/Donations to KF Projects	0/2, \$0/\$20k	1/4,\$1k/\$100k	0/4, \$200k
Student Internships	0 / 2	5 / 5	5 / 5



## Project Scorecard Narrative

1. **Companies Moved to Nevada** – Flirtey moved to Reno and opened an office on the UNR campus, citing the University’s strength in autonomous systems development.
2. **Start-up Companies** – No new ventures established at this time. Currently developing plans to create a spinoff company based on NAASIC R&D. The startup is expected to be operational before 04/01/2016.
3. **Jobs Created** – Alaska UAV has hired two former UNR students (part time) for flight testing. Drone America has sustained five positions due to NAASIC support. Flirtey has hired two UNR alumni in its expansion.
4. **Intellectual Property Licenses/Options Executed** – Nothing to report at this time.
5. **Intellectual Property Revenue** – Nothing to report at this time.
6. **Grants Received** – Money reported includes the \$130k to support the State’s FAA Test Site in UTM development and \$250k to support the State’s joint UTM development with NASA.
7. **Sponsored Research** – NAASIC is grouping sponsored projects funding under the “grants received” item above.
8. **Patents** – Nothing to report at this time.
9. **Students placed with Companies** - Flirtey hired two UNR graduates. Alaska UAV is planning to hire two UNR students.
10. **Impact Faculty Hired** – Three new UAS faculty hired in College of Engineering. Currently hiring grant writer. Technical director selected; offer acceptance pending.
11. **Gifts/Donations to KF Projects** - Kaempfer Crowell has made a verbal commitment to donate \$1,000 dollars to the “UNR Drone Zone” for the September 2015 Reno Air Races.
12. **Student Internships** - One intern hired for NAASIC’s NASA-related efforts. Two interns in the process of being hired for Alaska UAV. Two interns hired for Flirtey.



## Section III: Budget

<b>NAASIC Expenditures</b>			
For Reporting Period			
Month 1 – Month 31, 2015			
	<b>Estimate</b> (Year 1)	<b>Expenditures</b> Inception to Date June 1, 2014 – September 30, 2015	<b>Expenditures</b> Current Period July 1 – September 30, 2015
<b>Total Salary &amp; Benefits</b>	\$ 748,414.00	\$ 258,995.34	\$ 130,898.39
<b>Equipment</b>	\$ 196,250.00	\$ 170,585.25	\$ 42,499.50
<b>Travel</b>	\$ 25,000.00	\$ 16,847.87	\$ 5,508.40
<b>Other Direct Costs</b>	\$ 146,564.00	\$ 194,435.72	\$ 89,133.04
<b>Graduate Tuition</b>	\$ 7,500.00	\$ -	\$ -
<b>Total</b>	<b>\$ 1,123,728.00</b>	<b>\$ 640,864.18</b>	<b>\$ 268,039.33</b>

### Project Income Narrative

Project income in the present reporting period derives from three sources: two grants awarded to the State (which include support for the University by way of NAASIC), and one gift to NAASIC in support of NAASIC’s participation in the National Championship Air Races. Although the amount of money received by the State for the two grants exceeds \$1.5 million over five years, the portion earmarked for NAASIC is approximately \$380,000. Additionally, NAASIC received a \$1,000 gift to support its outreach work at the Air Races.



<b>NAASIC Income</b>			
For Reporting Period			
Month 1 – Month 31, 2015			
	<b>Estimate (Year 1)</b>	<b>Income Inception to Date June 1, 2014 – September 30, 2015</b>	<b>Income Current Period July 1 – September 30, 2015</b>
<b>Grants / Contracts*</b>	\$ 200,000.00	\$ 380,000.00	\$ 380,000.00
<b>Gifts</b>	\$ 20,000.00	\$ 2,000.00	\$ 1,000.00
<b>Cont. ED/ Outreach</b>	\$ -	\$ -	\$ -
<b>Other Contributions*</b>	\$ -	\$ -	\$ -
<b>Knowledge Fund</b>	\$ -	\$ -	\$ -
<b>Total</b>	<b>\$ 220,000.00</b>	<b>\$ 382,000.00</b>	<b>\$ 381,000.00</b>



## Section IV: Weekly/Monthly Logs of NAASIC Activities for Reporting Quarter

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| August 7th 2015   | August 14th 2015  | August 21st 2015  | August 28th 2015  | July 3rd, 2015  | July 10th, 2015   |
| NAASIC Weekly Repo  | NAASIC Weekly Repo  |
|  |  |  |  |   |   |
| July 17th, 2015   | July 24th 2015  | July 31st 2015  | September 4th, 2015   |   |   |
| NAASIC Weekly Repo  | NAASIC Weekly Repo  | NAASIC Weekly Repo  | NAASIC Weekly Repo  |   |   |



## Section V: Appendices

### Appendix 1 – Sales Pipeline

Company Name	Company Type	Opportunity Type	Notes (Progression and Next Step)
<b>Prospects - Interest (56 - 79)</b>			
Koch Industries	Conglomerate	Contract	Expressed interest in leveraging NAASIC expertise in air traffic management.
<b>Qualified - Desire (19 - 26)</b>			
Airware	Enterprise UAV	Contract	Interested in partnering with UNR for publicly-beneficial research and development.
Cloud Cap	Flight Controllers	R&D	Wants to work with Flirtey and UNR to deploy Piccolo FCU on Flirtey aircraft.
<b>Negotiation - Action (7 - 5)</b>			
Flirtey	Drone Delivery	Partnership	Continue flying with Flirtey under UNR’s delegated COA authority; pursue joint research projects.
Flight Research Associates	Aerospace Consulting	Partnership	Co-developing the NUANCE Lab.
GC2IT	Aerospace Consulting	Partnership	Co-developing hardware and software for Nevada-NASA partnership.
Reno-Tahoe Airport Authority	Airport Authority	Partnership	Co-developing the NUANCE Lab.

