

NEVADA INSTITUTE FOR AUTONOMOUS SYSTEMS QUARTERLY REPORT

December 31, 2015

4th Quarter, CY15



Prepared by:

Nevada Institute for Autonomous Systems

For

The Nevada Governor's Office of Economic Development



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4th Quarter 2015

Date Submitted: 31 January 2016

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Table 2 Test Site DAR and Contact Information

EXECUTIVE SUMMARY

Staff of the Nevada Institute for Autonomous Systems hereby submit the following as the Quarterly Report for the fourth quarter of 2015. The content in this report is an outline summary of the Nevada Test Site activities over the past 90 days.

The Nevada Governor's Office of Economic Development ("GOED") is the lead Nevada state entity for interface and coordinating with the FAA UAS PMO for developing and integrating the FAA's UAS Systems under the OTA. In turn, GOED has contracted to the non-



profit Nevada Institute for Autonomous Systems (NIAS) to operate and oversee the daily operations and management over the designated test site ranges, Nevada airspace development, and UAS Industry business lead generation. The Nevada Institute for Autonomous Systems, in turn, is staffed to provide management of the daily test site operations on behalf of GOED. The Governor's Office of Economic Development and NIAS personnel are hereinafter referred to collectively as ("Nevada personnel") in this report. Nevada personnel plan to maximize the utility of Nevada's assets to establish and operate an unquestioned center of entrepreneurship and business excellence, resulting in recognition of Nevada as a world leader in the autonomous systems business.

The Nevada Institute for Autonomous Systems has taken its primary lines of operation: Certificate of Authorization (COA) flight generation, airspace expansion, and business lead generation from the 3rd Quarter and accelerated all categories. This report focuses on these three lines to demonstrate significant change and innovation is increasing from quarter over quarter (Q/Q) across the Nevada UAS Industry. In addition, this report and the Nevada personnel have been focused on relationship and team-building initiatives to better synergize and synchronize Nevada towards becoming the global location of choice for unmanned air vehicle operations. To become a global leader, Nevada personnel and UAS Industry stakeholders continue to promote a shared UAS Industry message across all communication mediums.

ACCOMPLISHED ACTIVITIES DURING 4th QUARTER, 2015

(REPORTABLE IN THE COA ONLINE SYSTEM)

During the 4th Quarter, the FAA online reporting system recorded fifty-six (56) COA flights and NIAS recorded an additional eight (8) restricted areas flights. NIAS flew under multiple UAS R&D categories and flight profiles including UAS night operations, extended visual lines of operation, and survey data collection on infrastructure, wildlife, powerlines, and rail lines. The Nevada UAS Test Site mission tempo significantly represents an exponential 600%(+) increase in COA flights from the previous three months of air operations under the delegated FAA authority to the Nevada UAS Test Site. Notably, two weeks into the 1st Quarter, FY 2016, the Nevada UAS Test Site has already flown 75% of the aggregate 4th Quarter COA flights and is postured to double aggregate 4th Quarter COA flights by the end of the 1st Quarter, 2016. Table 3 identifies the NIAS air mission statistics:



Organization	Date	Total Flights	Location
Client Confidential (Large Agricultural/Commercial)	11-12 Oct 15	8	Restricted Area/NTTR
PrecisionHawk USA	26-27 Aug 15	0	Santa Cruz, CA (flights cancelled due to severe weather)
Drone America, AboveNV, UNR Dept. of Hydrogeology, & NAASIC	16-17 Nov 15	22	RRCC (Reno)
SkyWorks, AboveNV, Carbon Autonomous, & NAASIC	10-11 Dec 15	23	Hawthorne Advanced Drone Multiplex (HADM) Hawthorne, Nevada
Hyperloop Technologies UAS	21 Dec 15	8	North Las Vegas
Avisight (Channel 8)	31 Dec 15	3	Red Rock AO
TOTAL		64	

Table 3 - 4th Quarter Air Missions Completed

In addition to the increasing flight statistics for the 4th Quarter, Nevada personnel are also reporting these additional activities:

- During the quarter significant efforts were made to engage Nevada teammates and to investigate airspace regions that would facilitate a variety of applications and lay the ground work for beyond visual line of sight (BVLOS) UAS flight operations.
- Networking in the UAS community continued at a high pace with Nevada teammates and partners. NIAS attended the TAAC in Albuquerque, NM which proved to be a valuable conference for teaming and future business development.
- New UAS opportunities were identified with BEC Environmental and the Nevada Water Center of Excellence (COE) for mining and water use applications.
- Discussions with Nevada higher education institutions were initiated and UAS research opportunities in the areas of power utilization, cloud seeding, and air quality monitoring were identified.
- The potential relationship with Embry-Riddle Aeronautical University moved forward with scheduled COA flights and UAS training certification in the 1st Quarter.
- Based on a 2015 GOED RFP released in 2nd Quarter, 2015, three Nevada teammates/partners were recently selected to develop and test innovative UAS applications focused on increasing snowpack depths in the Lake Tahoe, Nevada region. The team selected to focus on reducing risk, increasing efficiency of airborne cloud-seeding include: Desert Research Institute (DRI) as the project lead, Drone America providing the experienced flight operations team, and Avisight coordinating and managing the project's airspace access with the FAA.



- The Hawthorne Army Munitions Depot, SOC, and the City of Hawthorne opened their entire 230 square mile complex to NIAS and the Nevada UAS Industry for research and development and advanced autonomous system training and testing. Nevada's newest UAS range is called the *Hawthorne Advanced Drone Multiplex (HADM)* featuring 17 UAS training and R & D outdoor sites in one location including a 3-mile diameter restricted area. Several Nevada UAV companies participated in the Hawthorne UAS demonstration day 10-11 December 2015.
- Nevada personnel established NIAS's first Cooperative Agreement (CA) and collaborative relationship (through the collaborative agency of UNLV Professor Paul Oh) with the Korean Civil UAS Research Consortium (K-CURC) to share UAS lessons learned, discuss R & D opportunities in Nevada, and to collaborate on business income streams. The K-CURC recently won a South Korean 30-million-dollar grant to grow the South Korean UAS Industry. This has the potential to create additional business streams for Nevada Teammates.

NIAS Business Development

Nevada personnel accomplished the following business development:

- Site visit to Hawthorne, Nevada to evaluate potential UAS operations with the military base and SOC for numerous applications including; parcel delivery, wildlife survey, water research, rail survey and infrastructure inspections.
- Site visit to Silver Springs Airport to evaluate potential UAS flight operations for rail and agricultural survey.
- Attended UAS Technical Analysis and Applications Center (TAAC) annual meeting in Albuquerque, NM for test site networking with the DoD, FAA, and NASA.
- Met with BEC Environmental to discuss the use of UAS applications to conduct a volumetric analysis of mining pits, tailings ponds, etc.
- Reviewed potential UAS use for Agriculture and water research with Nevada Water COE and DRI.
- Discussed rail survey, incident, tower and bridge inspection, and Pathfinder program with Union Pacific.
- Reviewed BVLOS development and testing program with teammates: Sapphire Innovations, Harris Corporation, RTAA and UNR/NAASIC.

NIAS Educational Outreach

Nevada personnel accomplished the following education outreach:

- Held introductory meetings with UNLV research group to discuss UAS COA flights and R & D opportunities including UAS power utilization.
- Reviewed with DRI the potential UAS research opportunities regarding cloud seeding, air quality monitoring, and ecosystem monitoring.



- Held meetings with Embry-Riddle Aeronautical University on conducting UAS COA flight certification and training in Nevada, and possible collaboration on UAS training course certification.

NASA-NIAS UTM Update

In late summer 2015, Nevada personnel with expert support from key stakeholders, secured a long-term NASA contract for the Nevada UAS Test Site to help develop the UAS Traffic Management (UTM) program and develop the Nevada Autonomous and NextGen Collaborative Environment (NUANCE) laboratory. The NASA UTM will be a phased rollout to enable UAS integration into the National Airspace by February 2017. The Nevada personnel NASA team includes: GOED (PI), NIAS (operational control and NASA PMO), Reno-Tahoe Airport Authority (RTAA), UNR, and GC2IT. The Nevada NASA team are successfully completing UTM Phase Build 1 with Build 2 scheduled for roll out and operational testing in October 2016.

During 2015/Q4, the Nevada NASA team worked all of the NASA required functional UAS Test Plans, Systems Security Management Plans, software agreements, and Reno-Stead COA enhancements to set the stage for proof-of-UTM performance flights in mid-April 2016. These performance flights, called the National Campaign, will be a testing mission set of at least four UAS aircraft flying in the air at the same time across the six FAA designated UAS Test Sites—all simultaneously monitored by the NASA UTM software. Notably, the Nevada NASA team are setting new achievements milestones to have even more visual and data situational awareness support than the first phase UTM software and management will provide. These achievements help to position Nevada as the NASA location of choice over any other potential NASA R & D location.

A key aspect of the NASA contract is the build-out and equipping of the Nevada Autonomous and NextGen Collaborative Environment laboratory (NUANCE Lab) where live UAS flight operations may be monitored in a laboratory environment; thus, allowing the Nevada UAS Test Site team to combine (mix) Live, Virtual, and Constructive (LVC) systems and scenarios in one testing setting. The NUAANCE laboratory enables the Nevada UAS Test Site to simulate and fully test advanced UAS systems (even those in early development or in design phase; – i.e., Constructive) and real and developmental flight management systems, processes and procedures in good-to-exceptionally extreme conditions at low risk in a laboratory environment. This Constructive environment adds value to the full integration of unmanned aerial vehicles into the manned National Airspace. The NUAANCE lab completed all planning, equipment acquisition, and extensive NASA agreements and approvals during Q4 to enable reliable and secure connection to the NASA LVC systems in early 2016.

PLANNED AND EXECUTED RESEARCH PROJECTS BY INSTITUTION

University of Nevada Las Vegas (UNLV)

UNLV focused on or are working several UAS projects simultaneously:

- Enhanced situational awareness using unmanned autonomous systems for disaster remediation (\$600,000, NSF, Yim in collaboration with UNR and University of Utah).
- Infrastructure for enabling mobile manipulation of unmanned aerial vehicle (MM_UAV) (Research and Design, \$256,000, P. Oh, NSF).



- Developed agile and robust consequence monitoring system (\$310,000, W. Yim, Sandia National Labs).
- The Flying Orchestra: A Flying Aerial Robot Live Entertainment System—UNLV plans to work on developing an indoor tracking system for coordinating multiple drones and visualizing musical signage while flying. (\$92,000, S. J. Kim and P. Stuberrud—with Skyworks, and Governor's Office of Economic Development).
- Development of Hybrid Power Source with Energy Harvesting Capability for UAS (Y. Baghzouz, \$75,000, Nevada Knowledge Fund (KF)—with Rechargeable Power Energy (RPE), Governor's Office of Economic Development).
- Developed Plug-and-Play Interchangeable Components for Unmanned Aerial System with Mobile Manipulation Capability (\$249,000, A. Barzilov and W. Yim, Savannah River Nuclear Solutions, LLC).
- Low-Cost Multiple Unmanned Aircraft System for Remote Contour Mapping of a Nuclear Radiation Field (\$48,000, P. Oh, NSTec).
- Developing Secure Communication Method for Cloud-based Small UAS Traffic Management (sUTM) (\$63,000, J. Jo and Y. Kim, Nevada NASA Space Grant Consortium).
- Effective Power Management of Harvested Power on Small Unmanned Aerial Vehicles. Nevada Space Grant Research in Science & Engineering and Hands on Projects (A. Latifi and V. Muthukumar).

University of Nevada Reno / Nevada Advanced Autonomous Systems Innovation Center (NAASIC)

UNR focused on or are working several UAS projects simultaneously:

- EPA and Weston Solutions, Inc. - NAASIC has begun a joint project with Weston Solutions to assist the Environmental Protection Agency (EPA) with the remediation of approximately 50 Uranium mines in the Navajo Nation. NAASIC will conduct a beta test of mapping operations at a site in northern Arizona in March.
- NASA SBIR/STTR - NAASIC is working with Alaska UAV to develop a NASA SBIR (Small Business Innovation Research) proposal to explore multi-vehicle cooperation and interoperability of UAVs for agricultural inspection and crop hazard remediation. This proposal is due February.
- IMCP - NAASIC has met with faculty in the UNR College of Business and the Executive Director of the Western Nevada Development District to discuss the possibility of submitting a 'Investing in Manufacturing Communities Partnership' (IMCP) Initiative proposal to the U.S. Department of Commerce Economic Development Administration. The



proposed “Manufacturing Community” would be centered on UAS technology, but would also include alternative motors, big data, and renewable energy.

- Archeological Surveys - NAASIC is consulting with a UNR graduate student in Anthropology whose research focuses on using UAVs to capture close range aerial imagery for the creation of 3D landscapes models at archaeological sites. There is considerable potential for using UAVs to collect data at the many archaeological sites in not only Nevada, but all over the U.S.

Desert Research Institute (DRI)

The Desert Research Institute is continuing to pursue UAS applications research and collaborations. The following are current and new activities.

Current Activities:

- DRI and Alaska UAV were informed that they will be receiving funding from the Nevada Governor’s Office of Economic Development to pursue agricultural applications of UAS. The team will acquire UAS multispectral data to assess field and crop conditions such as irrigation efficiency and crop stress.
- Adam Watts (DRI) has been collaborating with NASA Ames Research Center and Canadian companies to explore UAS wildfire applications and markets.
- Lynn Fenstermaker, DRI UAS Liaison, participated in the December NIAS training event, Hawthorne NV, where she completed the field training necessary for a FAA UAS observer certificate.
- Adam Watts (DRI) is acquiring and testing payloads for fire-related UAS operations.

New and Future Activities:

- DRI is waiting to hear if two grant proposals seeking over \$1M in funding to support UAS-related research and applications will be funded. Both proposals included collaborations with two Nevada UAS companies (Drone America and Alaska UAV).
- DRI is collaborating with the University of Nevada Reno (UNR) to advise engineering students on UAS related projects that will include 2-3 Reno-area UAS companies.
- Hans Moosmuller (DRI) with a team of researchers from UNR and University of Nevada Las Vegas (UNLV) were selected to submit a full proposal to the 2016 NASA EPSCoR Research CAN program (Experimental Program to Stimulate Competitive Research; Cooperative Agreement Notice). The proposal, which is currently under preparation, focuses on research that will examine wildfire science in the western U.S. and how UAS may safely be integrated into fire management and research.



- DRI is preparing and submitting two proposals totaling >\$2 million to federal sources to support further development of UAS work involving the existing DRI-Nevada UAS industry partnerships.

CHALLENGES

The accelerated Nevada airspace development and COA flight opportunities are beginning to cause a significant delay in processing FAA COA online new cases or modifications to existing (active) COAs. This gap between the unfilled (time sensitive) industry demand creates a visible drag on the Nevada UAS Industry growth. The next generation and demand for a Nevada unmanned beyond visual line of site (BVLOS) air corridor and the lack of establishing an FAA standard for BVLOS, the definition of, operational parameters, and safety case to develop BVLOS operations additionally impacts the Nevada Industry growth. A better synergistic effect would be to give the six FAA Test Sites priority of COA processing and the blanket authority to test the BVLOS parameters without building a comprehensive A-Z safety case where one has not been previously developed nor provided to the FAA Test Sites by the FAA. This approval-priority gap will be addressed at the Mid-April Technical Interchange (TIM) being hosted by the ND Test Site in Grand Forks, ND.

SUMMARY

Nevada personnel have established a new 4th Quarter milestone for achieving COA flights, opening up airspace opportunities, and significantly generating and stimulating the Nevada UAS business leads. Notably, the Nevada UAS Industry and stakeholders at all levels have been diligently working toward advancing the UAS Industry to new levels of operational excellence over the past 90 days. These efforts will be even more critical for 1st Quarter and beyond Autonomous Industry growth accomplishments. Building upon metrics and opportunities to increase COA flights, airspace expansion, and business lead generation, the Nevada Test Site is setting the condition to become the global location of choice for the Autonomous Industry.