

NEVADA UAS TEST SITE QUARTERLY REPORT

April 28, 2017

1st Quarter, CY17

Submitted in accordance with
Other Transactional Agreement
DTFACT15A-00000



Prepared by:

Nevada Institute for Autonomous Systems

for

The Nevada Governor's Office of Economic Development



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1st Quarter 2017

Date Submitted: April 28, 2017

Calendar Quarter Ending: 31 March 2017

Name: FAA-designated Nevada UAS Test Site (NIAS)

POC's & Contact Information

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Table 2 Test Site DAR and Contact Information



EXECUTIVE SUMMARY, 1st QUARTER, 2017

Per the Other Transaction Agreement (OTA) between the Federal Aviation Administration (FAA) and the State of Nevada, DTFAC15A-00000, Services to Support Safe Integration of UAS into the NAS MASTER AGREEMENT (MA) Modification #0001, January 17, 2017, the State of Nevada FAA Unmanned Aircraft Systems (UAS) Test Site submits the following 1st Quarter, 2017 report to the FAA. The content in this report is an outline summary of the Nevada UAS Test Site activities over the past 90 days through 31 March 2017.

The Nevada Governor's Office of Economic Development ("GOED") is the lead Nevada entity for interface and coordinating with the FAA UAS Department for developing and integrating the FAA's UAS Systems under the OTA. In turn, GOED has contracted with the non-profit corporation, the Nevada Institute for Autonomous Systems (NIAS) to operate, oversee, and perform profit and loss (P&L) budget responsibilities over designated Nevada UAS Test Site ranges and unmanned aviation activities as well as provide expert leadership to the Nevada UAS Industry. The NIAS manages unmanned aviation operations and logistic resources, develops expanded airspace opportunities, and generates UAS business leads that benefit UAS public and commercial companies. The NIAS is staffed with permanent senior management leaders with the unique responsibility to grow the Nevada UAS Industry on behalf of GOED. No other Nevada entity has this overarching and critical responsibility. The GOED and NIAS personnel are hereinafter referred to collectively as ("Nevada personnel") in this report.

During the 1st Quarter, CY 17, the FAA online reporting system recorded 91 Certificate of Authorization (COA) flights for the Nevada UAS Test Site. The pattern for longer duration flight hours have increased as industry technology matures. As the demand for visual line of sight (VLOS) UAS operations plateaus under Part 107 and existing public FAA Certificate of Authorizations or Waivers (COA), NIAS is focusing efforts on advancing new applications including; drone detection testing, long-distance package delivery, high altitude and long-distance cloud seeding, and beyond line of sight (BLOS) UAS operations utilizing multiple VOs (visual observers) or daisy chaining VOs. In addition, Nevada Personnel are supporting NASA's Unmanned Traffic Management (UTM) Technical Capability Level (TCL) advancing extended visual line of sight (EVLOS), beyond visual line of sight (BVLOS), ground-based sense and avoid, and airspace management operational testing.

As UAS technology advances so does the complexity of UAS operations. Commercial UAS operators are continually pushing the limits of existing innovations and developing new technology that allows UAS entities to fly higher and further; thus, increasing support operations relating to communications between pilots and ground VOs, daisy chaining VOs across the flight path, and contingency management operations in other than sparsely populated area. FAA regulations and procedures should continue to evolve to keep pace with these rapidly developing innovations



Nevada Accomplishments

Sensor Assessment - Extended Range >55 lbs. UAS Testing



Arcturus T-20 UAS

Location. Mesquite, Nevada, (February 1-3, 2017) with **NIAS and Arcturus UAV.**

Discussion. This testing plan featured a larger UAS weighing in at 188 lbs. The purpose of this test plan was to verify, validate, and demonstrate the Arcturus UAS T-20 advanced sensor suite for an international audience. The T-20 UAS flew three test flights for a total of 6.1 hours. This mission was indicative of how Nevada UAS Test Site COA flights have decreased with an exponential increase in COA flight time; thus, reflecting an inverse relationship between COA flights, innovations, and flight endurance. This also indicates that as the Nevada UAS Test Site testing involves larger UAS, the similarities to manned aviation increase. During the testing mission, the T-20 flew multiple flight profiles at various distances and altitudes to obtain sensor system data, performance characteristics, and live streaming video downloaded in real time to the Arcturus Command and Control unit.

Lessons Learned. The Nevada UAS Test Site had gleaned several positive lessons learned. All conditions were set with the FAA Nevada UAS Certificate of Authorization and Letter of Agreement to ensure all flight crews adhered to Nevada UAS Test Site airworthiness and safety procedures. As UAS systems get larger, the complexity of airworthiness reviews increase and contingency planning become critically important. Systemically, airworthiness processes and methods are the same for small and large UAS, but airworthiness reviews become more detailed with the larger UAS. There were zero accidents or incidents during the flight testing validating Nevada sUAS airworthiness procedures also apply to and effectively work for larger than 55 lbs. UAS. Maintaining visual contact with larger UAS is easier than small UAS; however, large UAS typically have different landing and take-off requirements and ground operational procedures, and since larger UAS fly faster, longer and at higher altitudes, the flight operation is different than sUAS flight operations. With the larger UAS, COA altitudes can increase to better accommodate these UAS.

Operational Challenges. Safety precautions were taken to accommodate a larger UAS at the remote Mesquite UAS Test Site. The City of Mesquite graded in a 600-foot runway to accommodate the larger UAS. From a training perspective, using more experienced flight crews with the larger UAS proved beneficial. The desert weather cooperated and the commercial UAS company accomplished all their test objectives with zero incidents or accidents.



Long-range BVLOS Cloud Seeding and Package Delivery in the NAS



Long-range BVLOS UAS Cloud-seeding and Package Delivery

Location: Hawthorne, Nevada, (February 14-15, 2017) with **NIAS, Drone America, AviSight, and Desert Research Institute (DRI).**

Discussion. The cloud-seeding accomplished a milestone by sending the Savant UAS across 39 miles validating on-board navigation and payload performance measures. The Nevada Team carried an internal load (package) setting the longest package delivery mission in the National Airspace to date. The Savant UAS delivered the package to the Hawthorne Industrial Airport and the cargo consisted of emergency supplies in a simulated lost hiker scenario. The test flight demonstrated that unmanned cloud seeding technology and capabilities can move beyond line of sight – a significant hurdle in this industry and most importantly, flight can be done safely and according to all FAA UAS regulations and guidelines. The flight crew members control and track the aircraft in real-time using computer-aided controls, but the pilot is not capable of visually following the aircraft during flight with the naked eye. The UAS operation incorporated multiple ground safety visual observers, an aerial safety observer in a Cessna 206 fixed-wing aircraft flown by Avisight, Drone Data Solutions and Services Company (replicating the integration of manned and unmanned aircraft in the same general aviation airspace), the Harris Corporation Symphony RangeVue for airspace surveillance of Automatic Dependent Surveillance – Broadcast (ADS-B) from manned aircraft, and application of a Notice to Airman (NOTAM) air corridor or flight advisory zone filed with the FAA. Reaching this UAS Cloud Seeding and Package Delivery milestone allows the Nevada Team to now focus on higher altitude flights at longer distances, as well as, the unique challenges of flying this one-of-a-kind technology in the harsh, icy weather that come with optimal winter cloud-seeding conditions.

Lessons Learned. Long-distance UAS flights are exponentially more complex in planning and execution. VO positioning and proper spacing of VOs across the route is critical to maintain line of sight of the flight crew to the UAS. Although visual contact was maintained through the entire flight, on future operation, VOs will be positioned closer together. Another aspect realized, flights over longer distances, deploying backup communications systems are critical to the successful completion of the mission.

Operational Challenges. Maintaining visual observation of the aircraft is more difficult at altitude above 1500 feet above the ground level with a smaller UAS. This fact is mitigated by flying the UAS directly over the stationary VO positions and mounting a manned-aircraft size strobe to the bottom of the UAS. Flying the UAS over contrasting terrain also helps maintain visual observation.



Expanded Operations (includes EVLOS and BVLOS)



NASA October 2016 TCL 2

Location. Nevada with NIAS, RTAA, and selected UAS industry partners.

Discussion. The Nevada UAS Test Site formed a new Nevada NASA Team made up of 15 industry partners, which includes several top tier or high visibility UAS, ground-based sense and avoid, airspace management, non-UAS companies. This Technical Capability Level (TCL) 2 National Campaign includes objectives and methodology of an experimental flight test effort designed to study the implementation of a ground-based airspace management tool in fielding UAS operations. The Nevada UAS Test Plan includes testing the performance of the UAS flight management tools integration with the UTM system, as well as, the operational procedures needed to use the UTM system in field operations. A new aspect to UTM is NASA's development of a UAS Service Supplier (USS) which sits between UAS operators and the Flight Information Management System (FIMS) and handles operational requests (flight plan submission and updates), constraint processing, real-time notifications to operators, and direct communication with other stakeholders (including the public). The NASA May 2017 TCL will be conducted at the Reno –Stead Nevada UAS Test Site location. NIAS and the Nevada NASA team have been engaged in ongoing test planning to build or enhance unmanned systems capability in the following technical and operational areas:

- a. Geofencing technologies / conformance monitoring.
- b. Airborne Sense and Avoid.
- c. Communication, navigation, and surveillance
- d. Human factors related to UTM data creation and display.
- e. BVLOS lessons learned and technical expertise to integrate into the future Nevada BVLOS air corridor architecture.
- f. Modifications and expansion of existing State of Nevada COAs to facilitate BVLOS.
- g. Simultaneous UTM UAS operations.
- h. Ability to contribute to NASA's Measures of Performance (MOP) standards Phase II.
- i. Developing UTM scenarios/objectives not developed by NASA and ability to write operational scenarios.

Specific activities in this quarter that were in direct support of this NASA TCL include:

- Wrote and published several Nevada Air Tasking Orders (NATOs) in support of the NASA customer.
- Formed new industry partnerships by establishing new teaming agreements and non-disclosure agreements with top UAS industry leaders.



- Wrote detailed technical and pricing proposal volumes in response to the NASA TCL and NIAS acts as the Prime Contractor to NASA.
- Weekly and sometimes daily phone calls/emails/go-to meetings with both NASA engineers and Nevada NASA Teammates.
- Submitted updated FAA COAs in support of NASA TCL.
- Renewed Letter of Agreement with the Reno –Tahoe Airport Authority (RTAA) and established new Letter of Agreements with two other airports near Reno, Nevada.
- Conducted several Airworthiness Review Boards for team partners.

COMMUNITY OUTREACH

College of Southern Nevada – NIAS met with organizers and instructors of the Aviation Technology group to discuss UAS program development. NIAS is now on the CSN UAS advisory committee.

Nevada State College - NIAS supported UAS program and curriculum development for a NASA Space Grant focused on UAS/STEM Teacher Training.

COLLABORATION

The City of Henderson, Nevada State College, and the Nevada UAS Test Site (NIAS) – The new Urban UAS Test Range (HUVR - Henderson Unmanned Vehicle Range) was officially opened at the Nevada State College, Henderson Nevada in January 2017. Improvements in the test range have begun and completion of the VTOL areas will be completed next quarter. The field elevation is 2,385 ft. MSL and Class G airspace is accessible under the Nevada test site COA for under 55 lb. UAS.



HUVR at NSC

City of Mesquite, Nevada and NIAS – Over the last quarter, NIAS has worked with the city of Mesquite to develop the UAS range. To accommodate larger UAS a new take-off and landing area with longer/wider and crossing runways was added and access road was improved.



Mesquite UAS Range

IMPROVEMENT IN SAFETY – RISK MANAGEMENT PROCEDURES

Over the last several UAS missions, NIAS has found that the use of extended range radio communications between ground operations (pilots and ground control stations) and VOs is extremely beneficial in UAS tracking. A VHF base station and innovative cellular communications systems strategically positioned at an optimum altitude and distance can enhance radio communications, which ultimately improves safety and risk management procedures. NIAS has fully integrated crew resource management (CRM) into every aspect of operations, training, and maintenance; thus, creating a shared mental model of safety for Nevada UAS Test Site public operations. With the FAA’s approval of the Nevada UAS Test Site to operate under Part 107, this same detailed level of integration will occur for commercial UAS operations. The Nevada UAS Test site found that risk management is a state of mind or perspective developed versus irregularly deploying as another aviation management tool.

EMERGENCY OPERATIONS



Dr. Chris Walach at the 2017 FEMA Region IX
& State of Nevada - Annual Public/Private Workshop

Experienced aviators are well-aware of changing weather conditions and the impact weather can have on flight operations. It is extremely important to frequently track weather conditions and to brief UAS flying teams of impending weather changes. This not only includes PICs and GCS operators, but also the VOs that are positioned in the field. A properly briefed and prepared team can avoid adverse weather conditions in the field. NIAS participated in the 2017 FEMA Region IX & State of Nevada - Annual Public/Private Workshop_9 Feb 2017 to increase awareness of drone use in emergency operations and the role drones could play.

SUMMARY

The Nevada UAS Test Site and NIAS continue to be a major value added institution to the State of Nevada, the FAA, and the commercial UAS Industry growth. Surpassing industry standards in aviation safety, UAS airworthiness standards and UAS package delivery, cloud seeding, and drone detection, Nevada personnel will continue to accelerate the Nevada UAS Industry growth and leading



by example across the U.S. commercial UAS Industry. Nevada personnel will continue to develop new relationships that result in real business opportunities for Nevada Teammates and the State of Nevada. Nevada personnel will also continue to create a State of Nevada UAS Center of Excellence unmatched by any other entity by increasing COA flight endurance, opening regional airspace opportunities, creating beyond visual line of sight testing capability, advance NASA UTM projects, and generating or stimulating the Nevada UAS business environment. Finally, Nevada personnel will continue to prepare for and capitalize on innovation to advance UAS public awareness, safety, airworthiness, and operational flight testing.