7-1-2014

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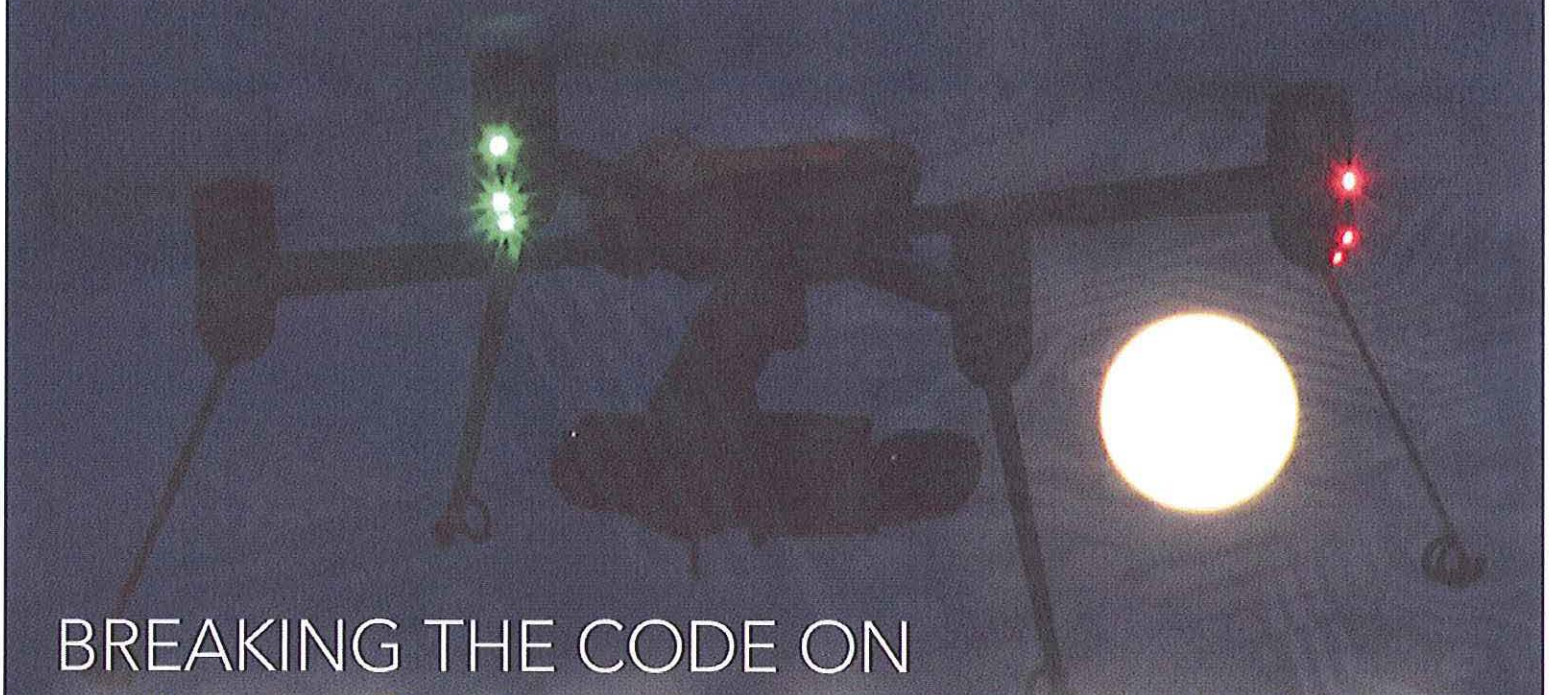
Alan Frazier
University of North Dakota, alan.frazier@UND.edu

Recommended Citation

Frazier, Alan. (2014). Breaking the Code on sUAS Night Flight Operations. Airbeat Magazine, July/August 2014, 42-44.



BREAKING THE CODE ON sUAS NIGHT FLIGHT OPERATIONS

By Alan Frazier, *Deputy Sheriff, Grand Forks (ND) County Sheriff's Office, Assistant Professor, University of North Dakota's John D. Odegard School of Aerospace Sciences* **Photos courtesy of Brenda Riskey,** UND Aerospace

They only come out at night.

It is a well-acknowledged fact that a disproportionate percentage of serious law enforcement incidents occur after dark. This is particularly true of violent crimes, such as assaults, robberies and rapes. Paradoxically, until recently, the Federal Aviation Administration had prohibited the use of small unmanned aircraft systems (sUAS) at night, other than by the FBI, which informed sources report already had a night sUAS certificate of authorization (COA).

Having been forced to curtail searches for two serious felons near Finley, ND, because of nightfall, Grand Forks County (ND) Sheriff's Department (GFSD) UAS Unit personnel had an interest in gaining FAA authorization to fly at night. Working in collaboration with FAA, GFSD set its sights on breaking the code of sUAS night operations.

"The flights were highly successful, validating the unit's belief that the aircraft could be seen at a greater distance at night, that manned air traffic was less frequent and that the night atmospheric conditions were more favorable to sUAS operations."

EASING OPERATIONS

Based on their collective experiences as FAA-licensed commercial pilots and flight instructors, GFSD UAS Unit personnel believed flying sUAS at night would actually be easier and safer than daytime sUAS operations. Less manned air traffic, the ability to see the navigation lights of the sUAS at a greater distance than during the day, less thermal generated turbulence and generally lighter winds were all factors that led the team to believe night operations would be simpler. The ability to respond to serious nighttime incidents was an added incentive.

In the summer of 2013, working closely

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with FAA UAS Integration Office personnel, GFSD submitted a nighttime training COA request to operate the AeroVironment Qube in a rural area beneath a block of uncontrolled airspace designated as Class-G. The UAS unit devised a set of safety mitigation procedures that included utilization of two visual observers, mandatory use of navigation lights and lighting of the sUAS takeoff and landing zone. As GFSD sUAS are also operated pursuant to University of North Dakota (UND) flight policies and procedures, the night safety mitigation plan was also vetted and approved by the university's flight operations safety office.

In September 2013, FAA issued GFSD a COA permitting night training operations of the AeroVironment Qube sUAS. UAS unit personnel then commenced a series of night testing and training flights to determine the feasibility of night sUAS operations. The flights were highly successful, validating the unit's believe that the aircraft could be seen at a greater distance at night, that manned air traffic was less frequent, and that the night atmospheric conditions were more favorable to sUAS operations.

LESSONS FROM TESTING

The unit learned numerous lessons from its early testing, including:

1. Obstacles such as trees, telephone poles, power lines and fences that are easily seen during the day are almost invisible on a dark night. One evening a calf, which had squeezed under an adjacent barbed wire fence, decided to graze in our landing zone. An extra team member was able to drive the errant calf back to its home. Use of powerful handheld spotlights is essential to conducting a pre-takeoff and pre-landing assessment of the landing area. Without such lighting, GFSD would have given the calf a surprise and possibly damaged the sUAS.
2. Chemical light sticks are useful in marking obstacles and outlining the landing zone. A light stick was also regularly used to mark magnetic north after a compass bearing was shot. (The Qube requires a magnetometer check as part of the pre-takeoff checklist.)
3. Operators must be organized and meticulous in managing unit equipment. It is easy to misplace equipment, such as compasses and anemometers, in the dark. Unit

personnel must carefully search the operations area with spotlights prior to departing in order to avoid running over or leaving equipment behind.

4. Human vision at night is not optimal. Depth perception and peripheral vision deteriorate significantly. The GFSD team attempted to offset these limitations by allowing at least 30 minutes of night vision adaptation prior to flying, generally flying at higher altitudes than during the day, using two visual observers, and periodically having one of the visual observers use a handheld spotlight to illuminate obstacles, the landing area and the sUAS.
5. An infrared sensor is essential for night operations. Standard electro-optical sensors are useless. Although the unit did not have a low light camera (LUX), feedback from Draganfly Innovations personnel indicates LUX cameras are highly effective at night. A sensor payload equipped with both an infrared and LUX camera would likely be ideal for night operations.

In November 2013, citing the experience gained from the night training COA, GFSD submitted night jurisdictional COA applications for the AeroVironment Qube, AeroVironment Raven and Draganfly X4ES. The 18,000-square-mile COAs were issued by FAA in March 2014. Over the past three months, GFSD has conducted dozens of night training flights with all three sUAS. The night operations have proven to be safe and provide the GFSD UAS Unit with the ability to respond to law enforcement incidents 24 hours a day.

It is important to note FAA UAS Integration Office personnel were supportive of the addition of night authorization and worked diligently towards making it happen. At times, it can be frustrating jumping through FAA regulatory hoops, but it is heartening to observe they are improving at collaborating on the integration of sUAS into the National Airspace System.