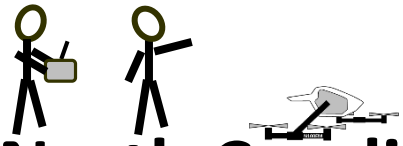
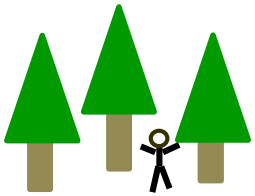




# North Carolina Emergency Management's UAS program

## Drone Workshop for Public Safety Agencies - Gastonia

**Gaston County Center**
**1303 Dallas-Cherryville Hwy**
**Dallas, NC**
**January 24, 2019**

**Jimmie Ramsey, Area 14 Coordinator, Western Branch**
**Curt D. Johnson, Technical Writer**

# Outline

- **Structure of NCEM's UAS program**
- **How NCEM plans to utilize UAVs**
- **Question and Answer period: Statewide deployable Remote Pilot database**

# NCEM's UAS program

- **If you are interested in receiving a digital copy of the following 83-page directions document:**

  *How to legally incorporate Unmanned Aircraft System (UAS) technology into your public agency's operations:*

  *I. Part 107 regulations route vs. II. Certificate of Waiver or Authorization (COA) route*

  **Then send an email:**

  **To:** curt.johnson@ncdps.gov

  **Subject:** UAS DIRECTIONS DOC

# NCEM's UAS program

- **Operate under an FAA Blanket Area Public Safety Agency Certificate of Waiver or Authorization (COA) (issued 2016-06-13)**

  **A. Self-certification of our remote pilots**

  **NCEM has a total of six FAA certificated Remote Pilots**

  – Before the FAA Part 107 rules became effective on 2016-08-29, NCEM's remote pilots were required under our self-certification agreement with the FAA to pass the **Private Pilot - Airplane (PAR) exam**

  – After the FAA Part 107 rules became effective on 2016-08-29, NCEM's remote pilots are now required under our self-certification agreement with the FAA to:

    - Pass the FAA "**Unmanned Aircraft General - Small**" exam
    - Be vetted by the **Transportation Security Administration (TSA)**
    - Be issued an **FAA Remote Pilot certificate**

# NCEM's UAS program

- **Operate under an FAA Blanket Area Public Safety Agency Certificate of Waiver or Authorization (COA) (issued 2016-06-13)**

**B. Coordination requirements**

Must file a **Notice to Airmen (NOTAM)**, which alerts pilots of the planned UAS activity, within a **72-24 hour** advanced notice time frame. **If it is an emergency**, the time can be reduced to **no less than 30 minutes prior to the operation**.

| | |
|---|---|
| **Distance (NM) and bearing from the closest VOR navigation aid** | 10 NM from the TYI VOR on the 122 radial |
| **Radius (NM) of operating area and Above Ground Level (AGL) operating elevation (ft)** | Radius of 0.7 NM from the surface to 400 ft AGL |
| **Distance and direction from the closest airport** | 3.0 NM SSE from the Tarboro-Edgecombe Airport (ETC) |
| **Hours of operation** | [Time (UTC), but also state the time in EDT or EST as a check]<br>1400-2200 UTC (10:00 am EDT to 6:00 pm EDT) |
| **Duration of activity** | October 15, 2016 – October 17, 2016 |
| **Coordinates** | [Have the center point's coordinates in both degrees, minutes, seconds (DMS) and decimal degrees (DD) in case requested.]<br>35°53'20.03"N, 77°31'43.90"W (35.888896° N, 77.528861° W) |

# NCEM's UAS program

- **Operate under an FAA Blanket Area Public Safety Agency Certificate of Waiver or Authorization (COA) (issued 2016-06-13)**

  **C. Communication requirements**

  **When operating in the vicinity of an airport without an operating control tower**, the Pilot in Command (**PIC**) will **alert manned pilots of the UAS operations by announcing on an appropriate airport** Universal Communications (**UNICOM**)/ Common traffic advisory frequency (**CTAF**) **frequency**.

| Pre-launch | During flight | Upon landing |
|---|---|---|
| Tarboro-Edgecombe traffic.<br>Tarboro-Edgecombe traffic. | Tarboro-Edgecombe traffic.<br>Tarboro-Edgecombe traffic. | Tarboro-Edgecombe traffic.<br>Tarboro-Edgecombe traffic. |
| Unmanned aircraft N190EM [read as "NOVEMBER, WUN, NINER, ZE-RO, ECK-OH, MIKE"] **will launch in 10 minutes and operate** at 330 ft approximately 3 nautical miles southeast of ETC (read as "ECK-OH, TANG-GO, CHAR-LEE"), the Tarboro-Edgecombe Airport. | Unmanned aircraft N190EM [read as "NOVEMBER, WUN, NINER, ZE-RO, ECK-OH, MIKE"] **operating** at 330 ft approximately 3 nautical miles southeast of ETC (read as "ECK-OH, TANG-GO, CHAR-LEE"), the Tarboro-Edgecombe Airport.. | Unmanned aircraft N190EM [read as "NOVEMBER, WUN, NINER, ZE-RO, ECK-OH, MIKE"] **has landed**. |
| The unmanned aircraft **will operate** within a 0.7 nautical mile radius of the TYI (read as "TANG-GO, YANG-KEY, IN-DEE-AH") VOR on the 122 (read as "WUN, TWO, TWO") radial 10 nautical mile fix. | The unmanned aircraft **is operating** within a 0.7 nautical mile radius of the TYI (read as "TANG-GO, YANG-KEY, IN-DEE-AH") VOR on the 122 (read as "WUN, TWO, TWO") radial 10 nautical mile fix. | Tarboro-Edgecombe traffic. |
| Tarboro-Edgecombe traffic. | Tarboro-Edgecombe traffic. | |

# NCEM's UAS program

- **Operate under an FAA Blanket Area Public Safety Agency Certificate of Waiver or Authorization (COA) (issued 2016-06-13)**

**D. Flight planning requirements**

This COA will allow **small UAS (≤55 lbs)** operations **during daytime visual meteorological conditions (VMC)** conditions **only within Class G airspace** under the following limitations:

- At or below **400 ft above ground level (AGL)**, and
- **Beyond the following distances from the airport reference point (ARP)** of a public use airport, heliport, gliderport, or water landing port listed in the Airport/Facility Directory, Alaska Supplement, or Pacific Chart Supplement of the U.S. Government Flight Info Publications:
  - **5 nautical miles (NM)** from an **airport** having an **operational control tower**, or
  - **3 NM** from an **airport** having a **published instrument flight procedure, but not having an operational control tower**, or
  - **2 NM** from an **airport not having a published instrument flight procedure or an operational control tower**, or
  - **2 NM from a heliport**.
- The **Pilot in Command (PIC)** is **responsible for identifying the appropriate ATC jurisdiction nearest to the area of operations defined by the Notice to Airmen (NOTAM)**.

# NCEM's UAS program

- **Operate under the FAA Addendum to approved COA for Public Safety Agencies (dated 2017-06-05)**

  In an effort to provide greater access into the National Airspace System (NAS) by public safety agencies across the nation, the FAA has amended approved COAs to now authorize public aircraft operators the ability to conduct **operations over people** and **nighttime operations when in compliance with the provisions listed below**:

  – ***Minimum Safe Altitude Operations***

  *A waiver from the requirements of 14 CFR 91.119 Minimum safe altitudes (b)* [1,000 ft over congested area] *and (c)* [500 ft over other than congested areas] *is approved as follows:*

  a. ***Except for those operations where it is necessary to safeguard human life**, no person may operate a small unmanned aircraft over a human being unless that human being is:*
     i. *Directly participating in the operation of the small unmanned aircraft; or*
     ii. *Located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small unmanned aircraft*

  b. *The groundspeed of the small UAS must not exceed 100 mph/87 knots*

  c. *The proponent must comply with 91.119(a).*

  d. *The proponent must report any accident/incident resulting in any human injury during COA operations over human beings.*

  *Note: People "directly participating in the operation of the small unmanned aircraft" may include qualified non-crewmembers, as defined in 49 USC 40125.*

  e. ***For those operations where it is necessary to operate over a human being in order to safeguard human life, the remote pilot in command must not operate any lower or in proximity to human beings [than] necessary to accomplish the operation.***

**NCEM requires an NCDPS lawyer to determine whether or not a proposed UAS operation over people meets the "*safeguard human life*" criterion**

Since the determination of whether or not a proposed UAS operation over people meets the "***safeguard human life***" criterion could be subjective, we have asked the NCDPS lawyer, Will Polk, to make that determination.

**Met the criterion:** The UAS operation to collect aerial imagery **over the drained Lake Surf**, which involved flying over some of the homes surrounding the lake with the UX5 fixed-wing, **met the "*safeguard human life*" criterion**, **because the operation collected topographic data that will be used to build a dam that would be strong enough to restore the lake and protect the people downstream.**

**Did not meet the criterion:** The UAS operation to collect aerial imagery **over the proposed Princeville housing development**, which would involve flying over the surrounding homes if conducted with the UX5 fixed-wing, did **not meet the "safeguard human life" criterion**, **because the flooding event was over.** Consequently, we did the operation with NCDOT flying their multirotors, which did not involve flying over the surrounding homes.

# NCEM's UAS program

- **Operate under the Addendum to approved COA for Public Safety Agencies (dated 2017-06-05)**

  In an effort to provide greater access into the National Airspace System (NAS) by public safety agencies across the nation, the FAA has amended approved COAs to now authorize public aircraft operators the ability to conduct **nighttime ops** and **ops over people** when in compliance with the provisions listed below:

  – ***Night Small UAS Operations.***

  *Small UAS operations may be conducted at night, as defined in 14 CFR § 1.1, provided:*

  a. *All operations under the approved COA **must use one or more visual observers (VO)**;*

  b. *Prior to conducting operations that are the subject of the COA, the **remote pilot in command (PIC) and VO must be trained to recognize and overcome visual illusions caused by darkness, and understand physiological conditions which may degrade night vision**. This training must be documented and must be presented for inspection upon request from the Administrator or an authorized representative;*

  c. *The **sUA must be equipped with lighted anti-collision lighting visible from a distance of no less than 3 statute miles**. The intensity of the anti-collision lighting may be reduced if, because of operating conditions, it would be in the interest of safety to do so.*

# NCEM's UAS program

- **Special Governmental Interest (SGI) [Emergency COA (eCOA)]**

  You will need a Special Governmental Interest (SGI), which was formerly referred to as an Emergency COA (eCOA), if any part of your proposed UAS operations site is within either of the following:

  - Temporary Flight Restriction (TFR)
  - National Security UAS Flight Restrictions area
  - Non-Class G airspace
  - Do not fly area around an airport as defined in your agency's COA

  – **What qualifies?:** Significant and urgent governmental interests [e.g. national defense, homeland security, law enforcement, & emergency operation (critical infrastructure)]

  – **Who can apply?:** Requested operations must be flown by a government entity or sponsored by a government entity

  – **UAS ops route?:** An agency can be operating under an active COA or Part 107 regs

  – **How to apply?:** https://www.faa.gov/uas/resources/event_archive/2017_uas_symposium/media/Breakout_1A_Options_as_an_Operator.pdf
  https://connect.ncdot.gov/resources/Aviation%20Resources%20Documents/Special%20Government%20Interest%20COA%20Addendum.pdf
  https://www.faa.gov/documentLibrary/media/Order/FAA_JO_7200_23_2.pdf

1. **Obtain documentation from the on-scene/incident commander or senior agency manager that:**
   - Grants approval to conduct the operation
   - Explains the emergency situation
2. **Contact the FAA Systems Operations Support Center (SOSC): 1). Phone (202-267-8276); and 2). Email a backup request to 9-ator-hq-sosc@faa.gov:**
   - The SOSC can be reached 24/7. It is staffed 6:00 am to midnight (ET) and then on-call from midnight to 6:00 am (ET)
   - The turnaround time on granting an eCOA is ~30-60 minutes once the form has been received by SOSC. However, it the request is for a safety of life op or a law enforcement op where the UAS op needs to start immediately, an eCOA can be granted over the phone before all the paperwork has been processed
3. **In your call to the SOSC (202-267-8276):**
   a. Request approval to conduct a UAS op in what type of restricted airspace.
   b. State the name of the government agency and contact info on the person who has granted approval for the UAS op
   c. Inform the agent whether or not you have a copy of the "**FAA REQUEST FOR AN ADDENDUM TO CURRENT COAA/FAA EXEPMPTION (E-COA) FOR UAS FLIGHT OPERATIONS**" & its date
   d. Be prepared to answer the questions on the form
   e. Follow the agent's directions
4. **The agent will contact you back:**
   a. If rejected, the agent will explain why or what additional info is needed.
   b. If accepted, the agent will provide directions or point out key provisions and/or stipulations.

# NCEM's UAS program

| Parameter | Trimble UX5 | Trimble UX5 HP |
|---|---|---|
| Type | Fixed-wing  | Fixed-wing  |
| Ground control station (GCS) | Yuma Tablet for pre-programmed flights | |
| Satellite guidance | **GPS** | |
| Takeoff | **Catapult launcher**. Requires 280 m for takeoff. The first 50 m must be clear of obstacles. The remaining section (50 m - 280 m) must be clear of obstacles above 15°. | |
| Landing | • **Linear**: 50 x 30 m landing zone. No obstacles above 12° along the landing path from 300 m to 25 m out.<br>• **Curved**: 75 x 30 m landing zone. No obstacles above 19° along the landing path from 300 m to 165 m out and no obstacles above 6° from 165 m to 50 m out. | |
| Sensor (digital camera)<br><br>GSD: Ground sample distance | 24 MP with a fixed focal length 15 mm lens:<br>• 2.0 cm (0.8") GSD @ 75 m (246 ft)<br>• 2.6 cm (1.0") GSD @ 100 m (328 ft)<br>• 3.13 cm (1.23") GSD @ 120 m (400 ft) | 36 MP w/ a fixed focal length set of lenses (**15**, 25, & 35 mm):<br>• 2.4 cm (0.9") GSD @ 75 m (246 ft)<br>• 3.2 cm (1.3") GSD @ 100 m (328 ft)<br>• 3.8 cm (1.5") GSD @ 120 m (400 ft) |
| Collects | Photos plus telemetry [**GPS** positioning (latitude, longitude, & elevation) and attitude (yaw, pitch, & roll)] | Photos plus telemetry [**GNSS** positioning (latitude, longitude, elevation) and attitude (yaw, pitch, & roll)] |
| Processing software output | • Georeferenced orthomosaic<br>• Digital elevation model (DSM or DTM)<br>• Measurements (distance, surface area, & volume) | |

**Stats for the 15 mm lens.** The 25 & 35 mm lenses get better GSD than the 15 mm lens, but need to be corrected for vignetting (image brightness reduction at periphery) at these elevations, which adds hours to the processing time.

The photogrammetry output is not in real-time. In fact, it can take 10-12 hours to process a flight.

If GCPs are set appropriately and the images are processed appropriately, the processing software could report an accuracy of 2 cm horizontally and 2 cm vertically or even better.

**Trimble does <u>not</u> report accuracy for the UX5**, because the accuracy depends on GSD and on:
- Whether or not ground control points (GCPs) are set
- Where the GCPs are set
- How the images are processed

# NCEM's UAS program

| Parameter | DJI Matrice 600 Pro | DJI Mavic Pro |
|---|---|---|
| Type | Multirotor | Multirotor |
| Ground control station (GCS) | Radio control + tablet | Radio control + smartphone or tablet |
| Satellite guidance | GPS | GPS |
| Takeoff<br>Landing | Vertical takeoff & landing (VTOL) | Vertical takeoff & landing (VTOL) |
| Special feature | Remotely activated hook for deploying a life vest, rope, rations, or a cell phone | Compact, moderately priced aircraft, and moderately priced batteries |
| Sensor (digital camera) | • **Zenmuse Z30 (zoom)**<br>• **Zenmuse XT (infrared)**<br>• ZX3 | • Built-in 12.34 MP camera with 28 mm lens |
| Collects | • Photos plus telemetry (latitude, longitude, elevation, yaw, pitch, & roll)<br>• Movies | Can be streamed for real-time viewing |
| Processing software output | • Georeferenced orthomosaic<br>• Digital elevation model (DSM or DTM)<br>• Measurements (distance, surface area, & volume) | The photogrammetry output will still take the same amount of time to process as if it were collected by a fixed-wing UAV. |

# Implementing UAS tech into emergency management operations

- During any emergency or disaster the priorities for emergency responders and managers remain the same:

**UAVs can help support these priorities:**

  - Protect lives → **Save victims, rescuers, & property**
  - Protect property → **Increase response effectiveness**
  - Protect the environment → **Expedite relief & recovery**
  - Recover as quickly as possible

Brewer, S. (2013, March). *Applications In Emergency Response and Public Safety*. Presented at the Civilian Applications of UAVs – A California Perspective, a Policy Symposium. Westlake Village, California. Retrieved from https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf

# NCEM operates under the four phases of Emergency Management

## Mitigation

Actions taken to prevent, reduce the chance of, or reduce the effects of a disaster

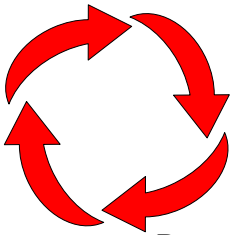
- **National Flood Insurance Program (NFIP)** section assists communities that participate in the NFIP.
- **Hazard Mitigation** section reduces the impacts of future natural hazards by identifying projects and funding to address local issues

## Preparedness

Actions taken to increase readiness & the ability to respond to a disaster

- **NC Floodplain Mapping Program (NCFMP)** determines flood hazard areas
- **Planning Operations** section assists communities to create an Emergency Operations Plan (EOP) (i.e. how to prepare for, respond to, and recover from a disaster)
- **Training & Exercise** branch conducts exercises and hosts training to prepare for various disasters
- **Public Information Officer (PIO)** informs the public on how to prepare for disasters (ReadyNC.org and ReadyNC app)

**UAVs can support each phase & act as a force multiplier**



## Recovery

Actions taken to restore an area and population to a pre-disaster condition

- **Individual Assistance** program helps families whose home has been damaged to secure housing and helps small business owners to restore damaged business property.
- **Public Assistance** program works with local governments to clear debris along roads and restore public infrastructure

## Response

Actions taken by emergency service personnel & agencies to saves lives and to protect property & the environment

- **NC Flood Inundation Mapping & Alert Network (FIRMAN)** produces real-time & forecasted flood maps
- **State Emergency Response Team (SERT)** coordinates relief efforts and provides support to local & county governments

# How UAVs could assist with each EM phase at various levels of government

- **Mitigation UAV applications**

  Actions taken to prevent, reduce the chance of, and/or reduce the effects of a disaster

  - Monitor development in flood hazard areas
  - Map and document pre-disaster conditions
  - Monitor hillsides subject to landslides
  - Monitor fuel loads in forests and natural areas

https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf

# How UAVs could assist with each EM phase at various levels of government

- **Preparedness UAV applications**

  Actions taken to increase readiness and the ability to respond to a disaster

  - Support training and exercise activities
  - Preplanning and familiarization for tactical responses
  - Provide high resolution aerial photos of hazard areas, evacuation routes, and safe zones

https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf

# How UAVs could assist with each EM phase at various levels of government

- **Response UAV applications (1 of 2)**

  Actions taken by emergency service personnel & agencies to saves lives and to protect property & the environment

  - Provide **real-time situational awareness** of threats and hazards (public and responder safety)
  - **Assess conditions of inaccessible, hazardous, and/or contaminated areas via images and sensors**
  - Determine status of roads and critical infrastructure
  - Provide geospatial references and navigation
  - Monitor response operations and effectiveness
  - Monitor the movement of persons, vehicles, resources, and provide security

https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf

# How UAVs could assist with each EM phase at various levels of government

- **Response UAV applications (2 of 2)**

  Actions taken by emergency service personnel & agencies to saves lives and to protect property & the environment

  - **Assist search and rescue operations**
  - Support or restore communications
  - Survey utilities and utility infrastructure

https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf

# How UAVs could assist with each EM phase at various levels of government

- **Recovery UAV applications**

  Actions taken to restore an area and population to a pre-disaster condition

  - Survey damaged areas and structures
  - Provide geospatial references and navigation
  - Determine status of roads and critical infrastructure
  - Assess conditions of inaccessible, hazardous, and/or contaminated areas via images and sensors
  - Monitor recovery operations and effectiveness
  - Monitor the movement of people, vehicles, & resources
  - Provide support for security in evacuated areas
  - Support or restore communications
  - Survey utilities

https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf

# Question and Answer

- **Statewide deployable Remote Pilot database**

  NCEM is creating a database of vetted **qualified** government agency sUAS remote pilots available for emergency & disaster support missions.

  - **Purpose**

    To provide, upon the request of a local first responder/emergency manager who contacts the State EOC, a list of **vetted** government agency sUAS remote pilots who are **qualified** & willing to serve when a need arises.

  - **Requirements**

    a. **Qualification**
       - FAA Part 107 Remote Pilot Certificate and an NCDOT UAS Government Operator Permit

    b. **Education and training**
       - 24 Hours of logged flight time as the Pilot in Command (PIC) of the UAS platform(s) that would be used

    c. **Flight standards documentation**
       - A letter of organizational affiliation signed by the agency head that explicitly states that the organization supports the applicant participating in the statewide deployable Remote Pilot database.
       - Proof of the organization's worker's compensation and liability insurance
       - Signed and executed NCEM release
       - FAA Certificate of Waiver or Authorization (COA) (if your agency has a COA)
       - FAA Part 107 Waiver (if your agency has any waivers)
       - Information on the UAS platform and its capabilities
       - PIC signs the flight standards attestation on the program application (abide by FAA and NC regulations, not fly under the influence, abide by the incident commander's deconfliction procedures, etc.)

  - **Review process**

    NCEM would review each application packet (application plus required docs) and issue an approval or a denial. NCEM would then enter into the database: the name of each approved applicant, equipment info, and support documents.

  - **For more info:** Please contact **Justin Graney** (justin.graney@ncdps.gov). The anticipated roll out is spring 2018.

# Question and Answer

- **Contact info**
  - Jimmie Ramsey, Area 14 Coordinator,  Western Branch

    Jimmie.Ramsey@ncdps.gov

  - Curt Johnson, Technical Writer

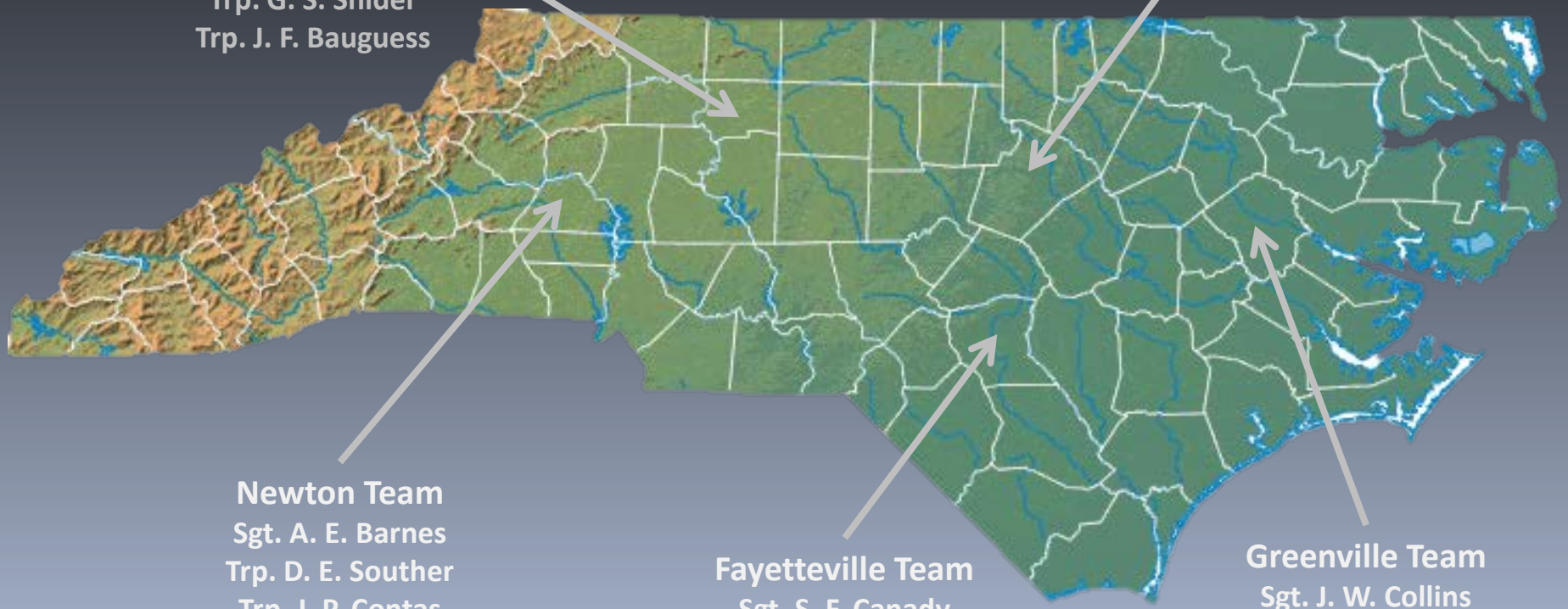
    Curt.Johnson@ncdps.gov

# North Carolina State Highway Patrol
# Collision Reconstruction Unit
# Trooper Brian Leventhal

# What is Collision Reconstruction?

Collision Reconstruction is the scientific process of investigating, analyzing, and drawing conclusions about causes and events during a vehicle collision.

# Collision Reconstruction Unit



**Winston Team**
F/Sgt. A. A. Justice
Sgt. B. K. Palmiter
Trp. D. H. Deal
Trp. G. S. Snider
Trp. J. F. Bauguess

**Cary Team**
Sgt. W. C. Johnson
Trp. B. N. Leventhal
Trp. R. W. Murphy
Trp. J. O. Melton

**Newton Team**
Sgt. A. E. Barnes
Trp. D. E. Souther
Trp. J. P. Contas
Trp. C. J. Rogers
Trp. D. J. Reid

**Fayetteville Team**
Sgt. S. F. Canady
Trp. J. C. Toon
Trp. J. H. Dixon

**Greenville Team**
Sgt. J. W. Collins
Trp. R. L. Cummings
Trp. D. W. Emory

# Our Mission

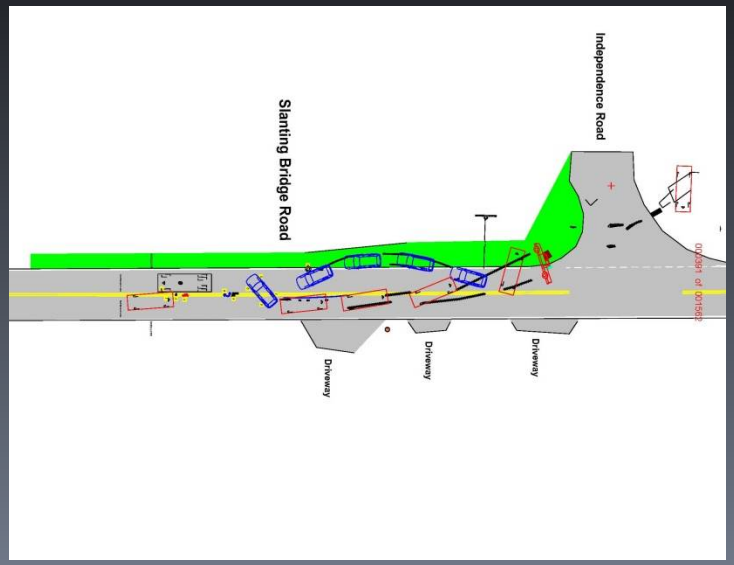
- Collision Reconstruction
- Crime Scene Documentation
- Respond to Natural Disasters
- Respond to Public Disturbances

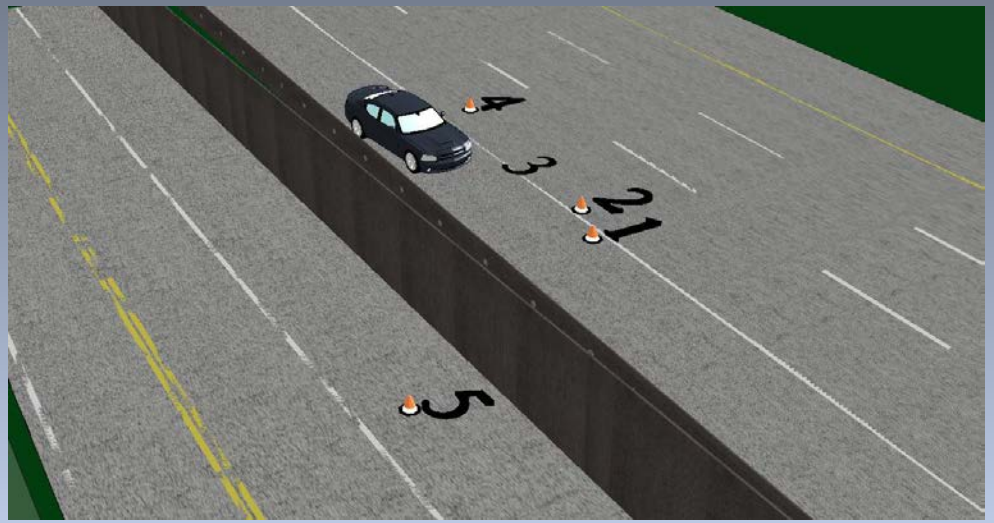
# Previous Methods of Measurement & Documentation

Measuring Tape


Nikon Total Station


# Finished Product



# Current Method of Measurement & Documentation

**Pros**

- Accurate
- Detailed
- Measurable
- 3D Images

**Cons**

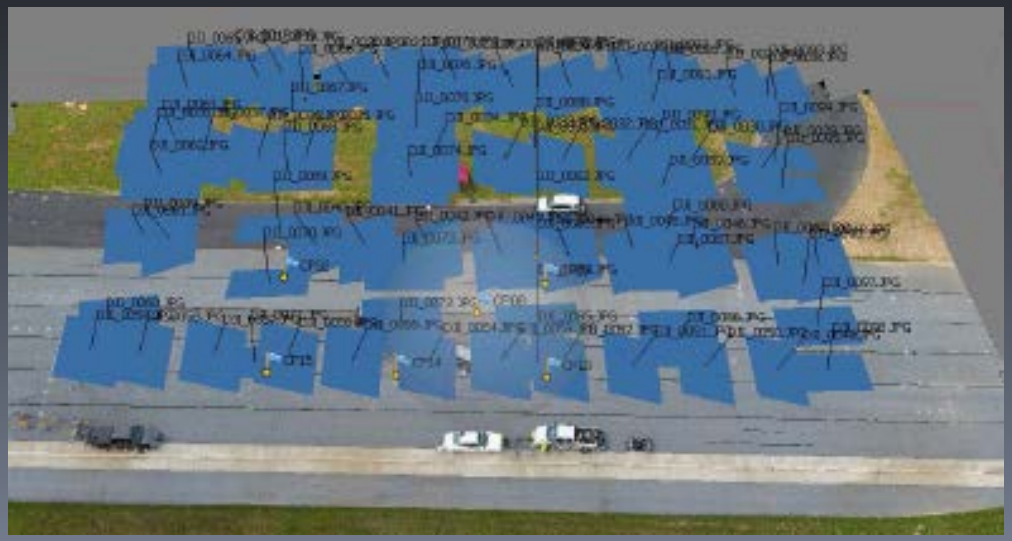
- Time Consuming


**FARO Focus3D X330 Laser Scanner**

# Finished Product

# More Efficient Method of Measurement & Documentation


# Finished Product



**Pros**

- Accurate
- Measurable
- Detailed
- 3D Images

**Cons**

- ~~Time Consuming~~

Images and data provided by the UAS Program Office Division of Aviation – NCDOT from the Collision Scene Reconstruction using Unmanned Aircraft Systems Study

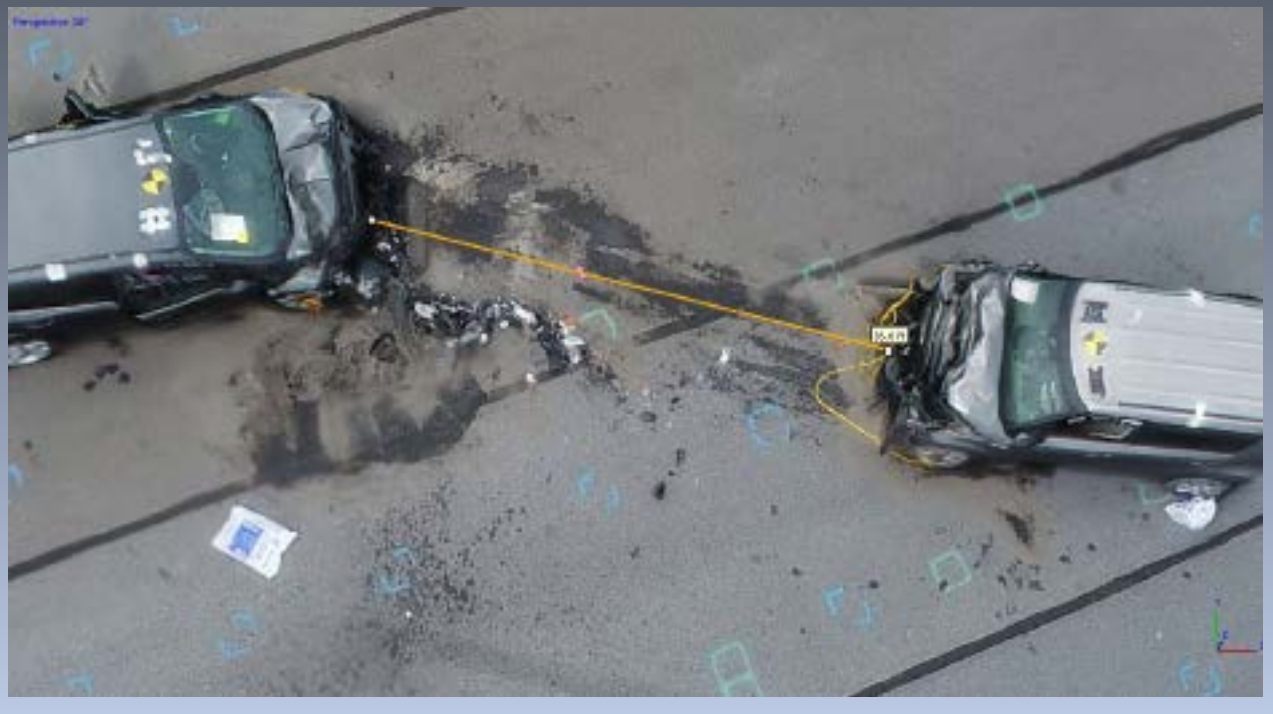
# Study of Collision Scene Reconstruction using Unmanned Aircraft Systems

- Study conducted on May 22, 2017 at the Buncombe County Public Safety Training Facility
- UAS Program Office, Division of Aviation – NCDOT
  NCSHP Collision Reconstruction Unit
- 40 mph head-on collision
- Scene was mapped by NCDOT DOA UAS Flight Team using 3 different UAS's (DJI Mavic Pro, Phantom 4, & Inspire 2)
- NCSHP Collision Reconstruction Unit mapped the same scene with the FARO Focus3D X330 Laser Scanner

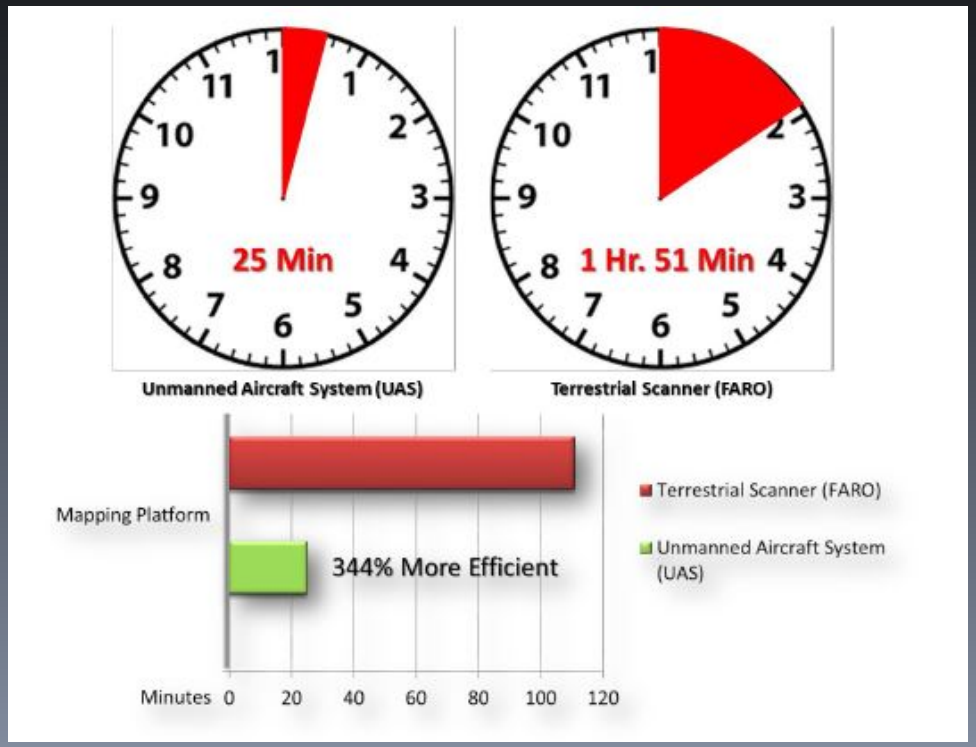
# Accuracy

- Determined using 6 ground control points
- Points were surveyed by NCDOT Field Survey Office
- Accuracy was found to be within .03 ft. (.36 in.)

Skid comparison



# Time to Map Comparison




# 40 mph Head-on Collision

# Low Light Collision Scene Reconstruction Study

- January 2018
- NCSHP Driver Training Facility
- Used NCDOT's nighttime flying waiver

Dr. Joseph Eyerman
Brad Mooring

RTI INTERNATIONAL

Dr. Srinivas Akella

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DIVISION OF AVIATION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

# Low Light Collision Scene Reconstruction Study

- Can drones be used in low light conditions to collect data comparatively to, or better, than current methods?
- Various components were evaluated to compare their performance and output measurements (UAV's, analytic software, lighting systems).
- This testing will inform future research & best practices for using drones at night for collision reconstruction.

# Aircraft Evaluated

DJI Phantom 4 Pro
DJI Inspire 1 w/ thermal sensor
DJI Mavic Pro

Different lighting configurations evaluated.

- Portable light towers
- Inflatable light tower
- Daylight
- Darkness

# Low Light Collision Scene Reconstruction Study Test Results…

# To Be Continued

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