



# Implementing unmanned aerial vehicles (UAVs) in emergency management

NCLGISA Conference 2015

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Mike Sprayberry, Director of NCEM

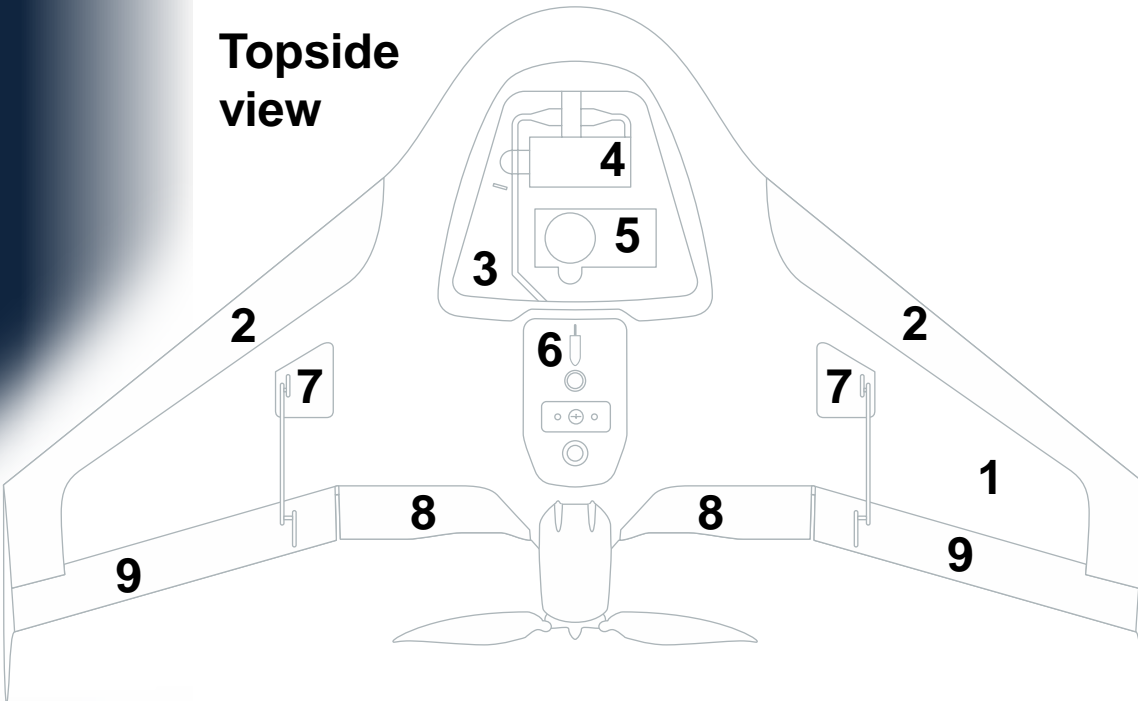
Gary Thompson, Chief of NC Geodetic Survey

# Terms

- **UAV:** Unmanned aerial vehicle
- **UA:** Unmanned aircraft
- **UAS:** Unmanned aircraft system, which according to the FAA includes *“the unmanned aircraft (UA) and all of the associated support equipment, control station, data links, telemetry, communications and navigation equipment, etc., necessary to operate the unmanned aircraft”*

# UAS components: The UAV

**Topside  
view**

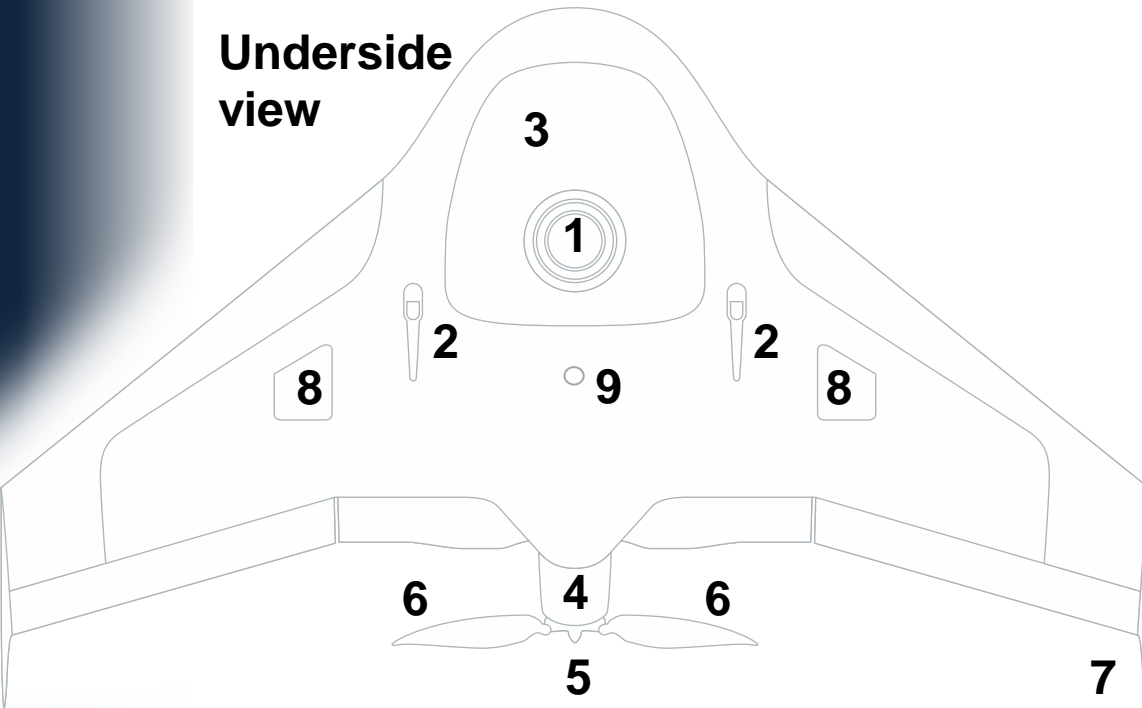


Note: Although the various UAS models are built and operated differently, this slide and the following ten slides use the Trimble UX5 (<http://uas.trimble.com/ux5>) fixed-wing UAS to illustrate the following UAS parameters: subcomponents of a UAV, ground control station, flight monitoring, and clearances (e.g. take off, cruise, descent, and landing).

1. Expanded polypropylene (EPP) body
2. Leading edges
3. Payload bay
4. Battery
5. Sensor
6. eBOX (GPS ant, Mode, & Pitot tube)
7. Servos
8. Inboard elevons
9. Outboard elevons

# UAS components: The UAV

Underside  
view



1. Lens filter
2. Launcher slats
3. Belly plate
4. Drive unit
5. Propeller holder
6. Propellers
7. Winglets
8. Servos
9. RF antenna (part of eBox)

<http://uas.trimble.com/ux5>

# UAS components: The GSC

## Ground control station (GSC)



Trimble Yuma 2 tablet running the Trimble Access Aerial Imaging software



UX5 ground modem (2.4 GHz) straps to the tablet, connects to the tablet via its USB cable, and communicates with the aircraft via its RF antenna.

<http://uas.trimble.com/ux5>

# UAS flight monitoring: The pilot & the flight observer

- **The pilot:**

- Monitors the GSC display

- Battery (%) & estimated battery life
- Radio status
- GPS status
- Trajectory (turns, level flight)
- Airspeed (kph)
- Throttle
- Height (m)



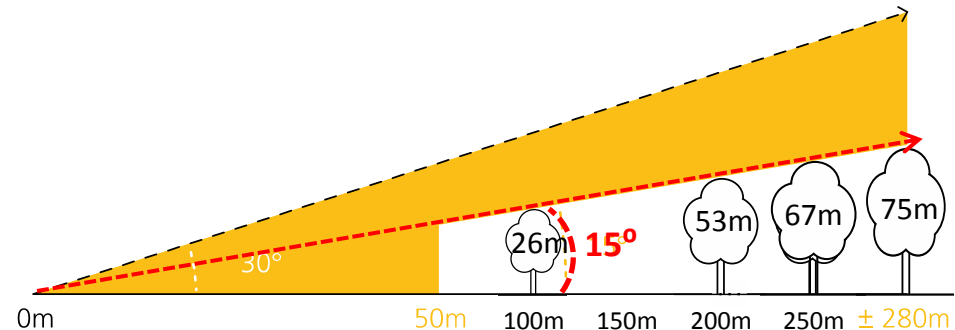
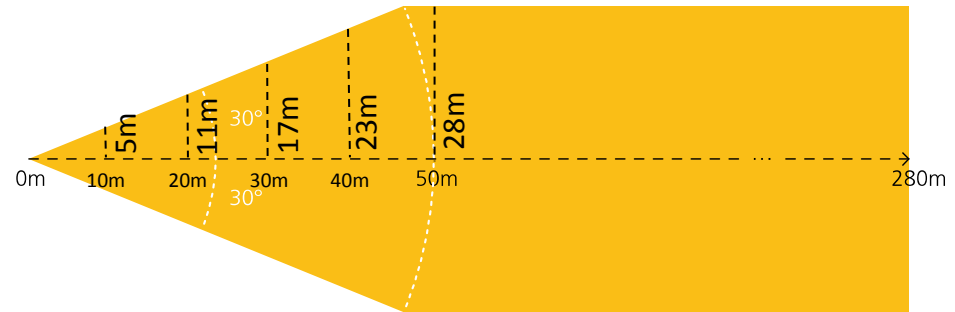
# UAS clearances: Take-off

- **Obstacle clearances for takeoff**

- **HORIZONTAL CLEARANCE:**

Within the first 50 m (164 ft), there must be a clear area free of obstacles within 30° to the left and to the right of the launch direction

- **VERTICAL CLEARANCE:** Within 280 m (919 ft) of the launch direction, no obstacles can be above a 15° safety angle

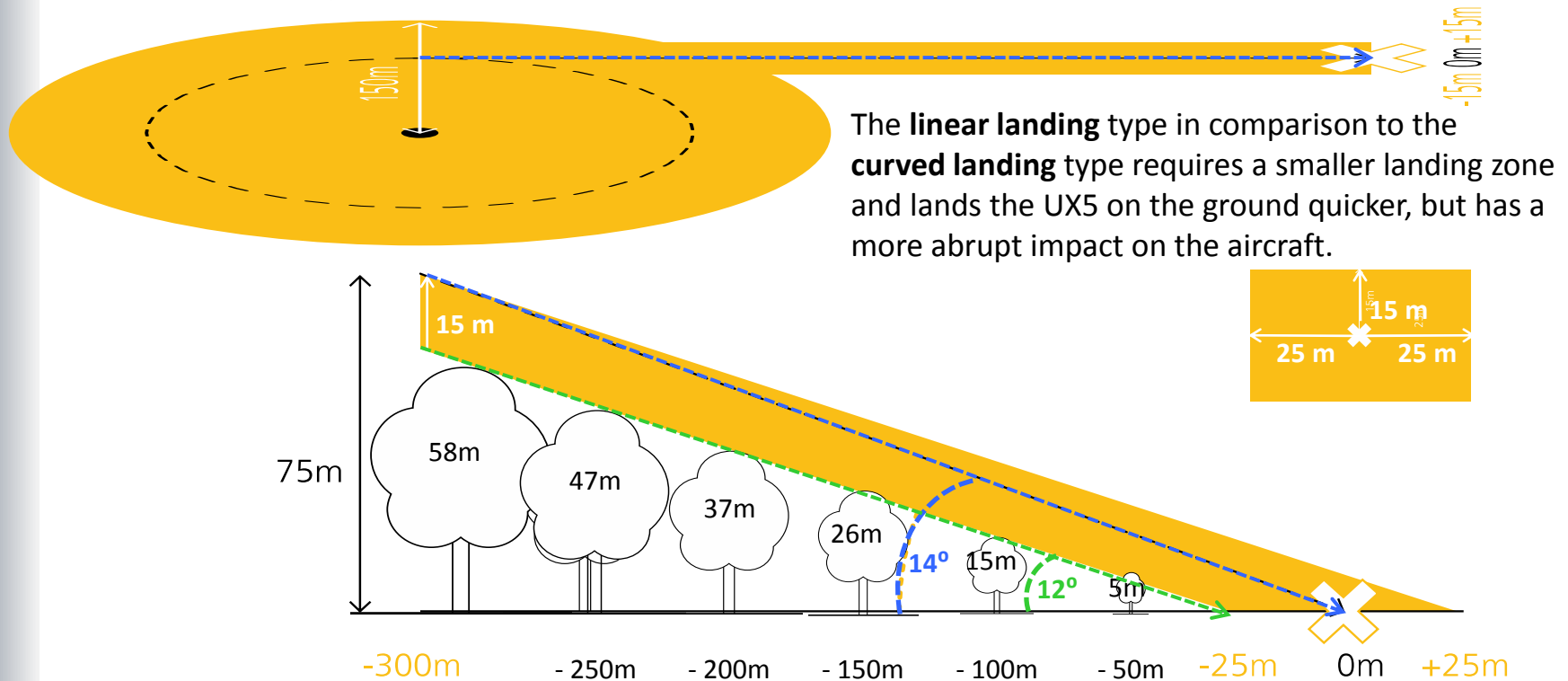


<http://uas.trimble.com/ux5>



# UAS clearances: Landing

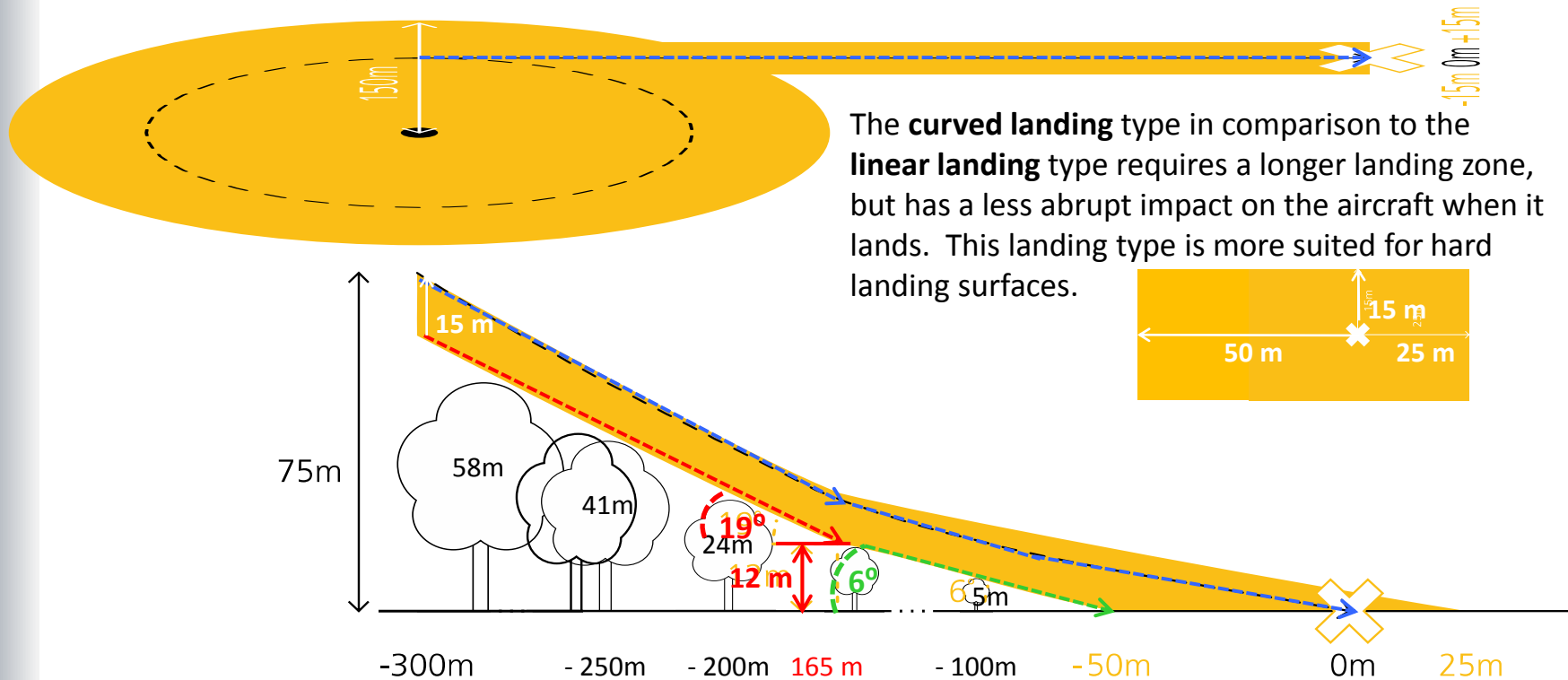
- **Obstacle clearances for landing**
  - **Linear landing:**





# UAS clearances: Landing

- **Obstacle clearances for landing**
  - **Curved landing:**



# NCEM is partnering with NGAT

- **NextGen Air Transportation (NGAT)**
  - Focuses on **developing and evaluating improvements** to existing and anticipated air traffic control, airspace management, airport and airspace system capacity, surface traffic management, and flight safety, specifically as it relates to the integration of **Unmanned Aircraft Systems (UAS)** into **domestic airspace**.
  - NGAT has led the State of North Carolina's UAS efforts for the last three years.

<http://www.itre.ncsu.edu/ngat/>

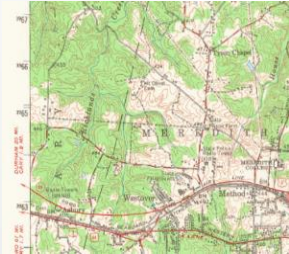
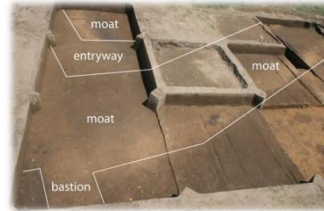
# NCEM is partnering with NGAT

- **NextGen Air Transportation (NGAT)**
  - The Federal Aviation Administration (FAA) has selected the **ASSURE (Alliance for System Safety of UAS through Research Excellence) team**, which is a Mississippi State University led coalition of research universities that includes **NGAT**, as the **Center of Excellence for Unmanned Aircraft Systems (UAS)**.
    - **NGAT will be the national team's lead for Command and Control Communications research** (i.e. development of an appropriate link between the unmanned aircraft and the control station to support the required performance of the unmanned aircraft and to ensure that the pilot always maintains a threshold level of control of the aircraft).
    - NGAT will lead all University of North Carolina system research about the safe integration of UAS into the national airspace

[https://www.faa.gov/news/press\\_releases/news\\_story.cfm?newsId=18794](https://www.faa.gov/news/press_releases/news_story.cfm?newsId=18794)

<https://news.ncsu.edu/2015/05/nc-state-team-selected-for-faa-unmanned-aircraft-center-of-excellence/>

# Hundreds of potential applications



- Emergency response
- Mapping / aerial photography
- Homeland Security
- Civil Air Patrol
- Agriculture
- Mining
- Forestry
- Wildlife resources
- Transportation
- Investigation
- Drug enforcement
- Anti-terrorism
- Law enforcement
- First responder support
- Weather research
- Disaster analysis
- Airport planning
- Entertainment (filming a movie)



## Emergency response



# Fire management







# Infrastructure management





# UAV imagery from NGAT

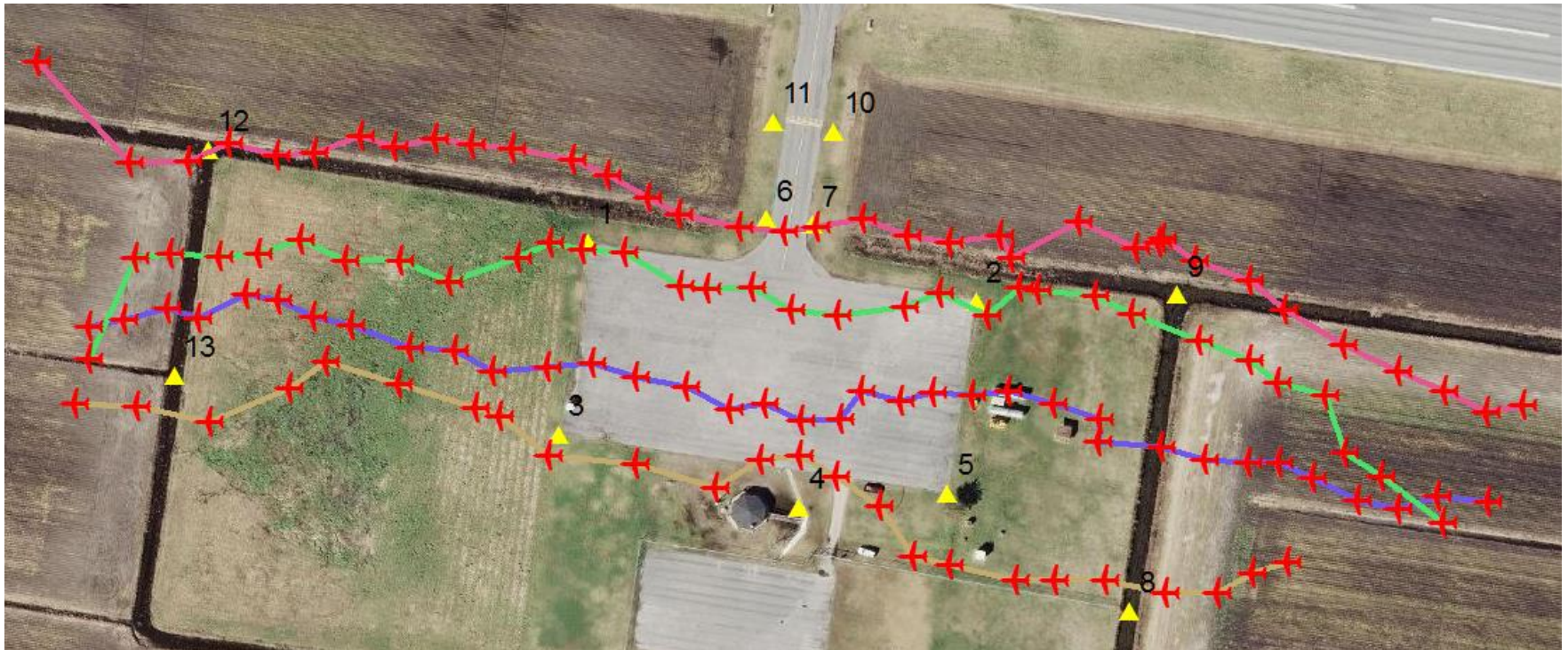
- **Hyde County Airport**

- Flew 4 flight lines and collected 127 images

- Variable forward and side overlap
- No surveyed ground control points (GCPs). Used 2012 statewide ortho & LiDAR



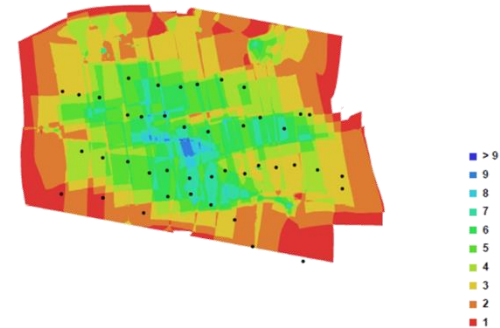
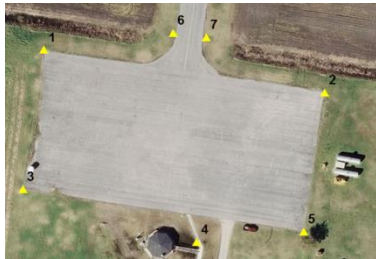
[www.boshtech.com/nsuperswiper.html](http://www.boshtech.com/nsuperswiper.html)



# UAV imagery from NGAT

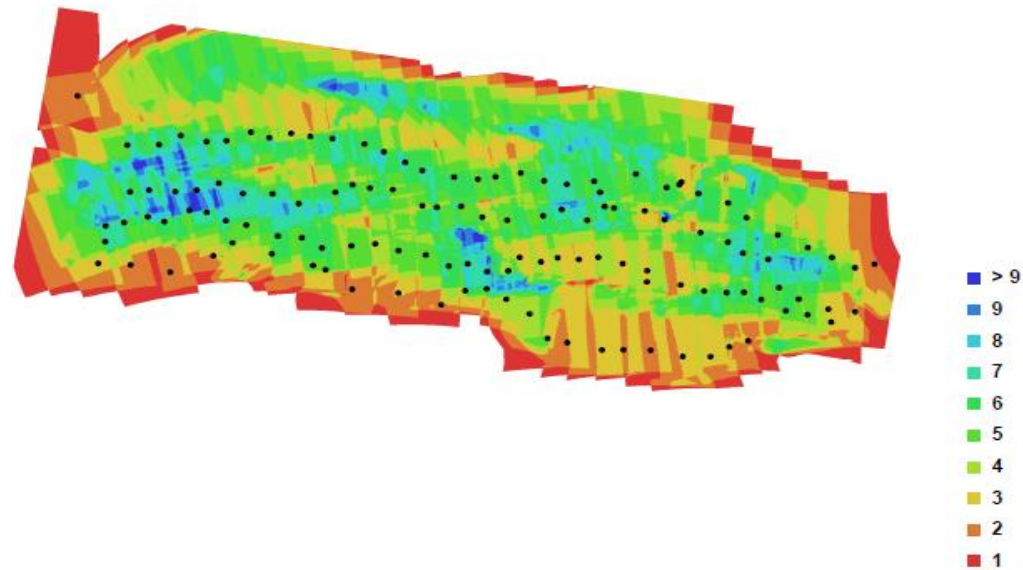
- **Hyde County Airport**

- Initial attempt to “align” all 127 images without any GCPs failed
- Used a subset of 44 images and 7 GCPs for alignment, which generated a camera calibration for input to subsequent processing



# UAV imagery from NGAT

- **Hyde County Airport**
  - Second attempt to “align” all 127 images successful
  - Used 11 GCPs to generate orthophoto and point cloud



# Current NC UAS policy activities

- FAA is THE authority today
- UAS operated by state agencies are “public aircraft”
  - **Must have a COA (Certificate of Authorization) from FAA**
  - Must meet NC requirements in addition to federal laws
- Current UAS operations by state/local agencies require approval from the State Chief Informational Officer (CIO)
- 2014 NC UAS legislation highlights
  - No UAS may be launched from any State or private property without consent. Local governments may adopt similar rules.
  - Allows civil penalty of up to \$5000.00 for unwarranted surveillance by UAS.
  - Requires NCDOT Division of Aviation to develop a knowledge and skills test for operating UAS not later than May 31, 2015. Test must comply with state and federal regulations. A working group has been formed to address this test.
  - Division of Aviation is required to immediately begin developing a Commercial licensing system that complies with FAA guidelines (not yet developed). Within 60 days of FAA authorization be able to implement commercial license requirements.



# Federal Aviation Administration (FAA): Regulations

- **Unmanned aircraft systems (UAS)**

UAS are inherently different from manned aircraft. Introducing UAS into the nation's airspace is challenging for both the FAA and aviation community, because the U.S. has the busiest, most complex airspace in the world. The FAA is taking an incremental approach to safe UAS integration.

- **[Integration of Civil Unmanned Aircraft Systems \(UAS\) in the National Airspace System \(NAS\) Roadmap](#)**

- **Different Types of UAS Operations**

- **[Public Operations](#)** (Governmental)
- **[Civil Operations](#)** (Non-Governmental)
- **[Model Aircraft](#)** (Hobby or Recreation *only*)

<https://www.faa.gov/uas/>

# Federal Aviation Administration (FAA): Regulations

- [Integration of Civil Unmanned Aircraft Systems \(UAS\) in the National Airspace System \(NAS\) Roadmap](#)

The first annual UAS Roadmap addresses current and future policies, regulations, technologies and procedures that will be required as UAS operations increase in the nation's airspace.



[https://www.faa.gov/uas/media/UAS\\_Roadmap\\_2013.pdf](https://www.faa.gov/uas/media/UAS_Roadmap_2013.pdf)

# Federal Aviation Administration (FAA): Regulations

- **Public operations (governmental)**

[Public Aircraft Operations](#) are limited by federal statute to certain government operations within U.S. airspace. Title 49 U.S.C. § 40102(a)(41) provides the definition of "Public Aircraft" and § 40125 provides the qualifications for public aircraft status. **Whether an operation qualifies as a public aircraft operation is determined on a flight-by-flight basis, under the terms of the statute.** The considerations when making this determination are:

- Aircraft ownership
- Operator
- Purpose of the flight
- Persons on board the aircraft

[http://www.faa.gov/uas/public\\_operations/](http://www.faa.gov/uas/public_operations/)



# Federal Aviation Administration (FAA): Regulations

- **Public operations (governmental)**

The [FAA Modernization and Reform Act of 2012](#) directed the FAA to:

*“allow a government public safety agency to operate unmanned aircraft **weighing 4.4 pounds or less**, if operated*

- i. **Within the line of sight of the operator**
- ii. **Less than 400 feet [122 m] above the ground**
- iii. **During daylight conditions**
- iv. Within [Class G airspace \[uncontrolled\]](#)
- v. **Outside of 5 statute miles from any airport, heliport, seaplane base, spaceport, or other location with aviation activities.”**

[https://www.faa.gov/news/fact\\_sheets/news\\_story.cfm?newsId=14153](https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14153) <http://www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf>

# Federal Aviation Administration (FAA): Regulations

- **Public COAs**

For public aircraft operations (PAOs), the FAA issues a [Certificate of Waiver or Authorization \(COA\)](#) that permits public agencies and organizations to:

- Operate a particular aircraft,
  - For a particular purpose
  - In a particular area
- Allows an operator to use a defined block of airspace
- Includes special safety provisions unique to the proposed operation
- Usually issued for a specific period (up to two years)

[http://www.faa.gov/uas/public\\_operations/](http://www.faa.gov/uas/public_operations/)

# Federal Aviation Administration (FAA): Regulations

- **Public COAs**

The FAA works with these organizations to develop conditions and limitations for UAS operations to ensure they do not jeopardize the safety of other aviation operations.

- The objective is to issue a COA with parameters that ensure a level of safety equivalent to manned aircraft.
  - UAS does not operate in a populated area
  - Aircraft is observed, either by someone in a manned aircraft or someone on the ground, to ensure separation from other aircraft in accordance with right-of-way rules.
- Common public uses today include:
  - Law enforcement
  - Search and rescue
  - Firefighting
  - Military training
  - Border patrol
  - Other operations
  - Disaster relief

[http://www.faa.gov/uas/public\\_operations/](http://www.faa.gov/uas/public_operations/)

# Federal Aviation Administration (FAA): Regulations

- **Public COAs**

The FAA manages public aircraft COAs through its [COA Online system](https://ioeaaa.faa.gov/oeaaa/) (<https://ioeaaa.faa.gov/oeaaa/>):

- Agency must submit a "**declaration letter**" from the city, county, or state attorney's office assuring the FAA that:
  - The proponent is recognized as a political subdivision of the government of the State
  - The proponent will operate its unmanned aircraft in accordance with 49 USC. § 40125(b) (not for commercial purposes)
- Note: An agency's accountable executive cannot self-certify their agency is a "public" agency.
- The typical COA application approval process is completed within 60 business days of receipt, provided there are no submittal errors, missing information, or safety or airspace issues.
- Email the **FAA/UAS Integration Office** ([9-AJR-36-UAS@faa.gov](mailto:9-AJR-36-UAS@faa.gov)) to get started.

[http://www.faa.gov/uas/public\\_operations/media/Decision\\_Flowcharts\\_for\\_PAO.pdf](http://www.faa.gov/uas/public_operations/media/Decision_Flowcharts_for_PAO.pdf)

# Federal Aviation Administration (FAA): Regulations

- **Civil operations (non-governmental)**

Any operation that does not meet the statutory criteria for a [public aircraft operation](#) is considered a civil aircraft operation and must be conducted in accordance with all FAA regulations applicable to the operation.

There are two methods of gaining FAA authorization to fly civil (non-governmental) UAS:

- [Section 333 Exemption](#) – a grant of exemption in accordance with Section 333 AND a civil Certificate of Waiver or Authorization (COA);
  - To perform commercial operations in low-risk, controlled environments.
  - [Instructions](#) for filing a petition for exemption.
- [Special Airworthiness Certificate \(SAC\)](#) – applicants must be able to describe how their system is designed, constructed, and manufactured, including engineering processes, software development and control, configuration management, and quality assurance procedures used, along with how and where they intend to fly.

[https://www.faa.gov/uas/civil\\_operations/](https://www.faa.gov/uas/civil_operations/)

# Federal Aviation Administration (FAA): Regulations

- **Civil operations (non-governmental)**

- [Section 333 Exemption](#)

By law, any aircraft operation in the national airspace requires a certificated and registered aircraft, a licensed pilot, and operational approval. [Section 333 of the FAA Modernization and Reform Act of 2012 \(FMRA\)](#) grants the Secretary of Transportation the authority to determine whether an airworthiness certificate is required for a UAS to operate safely in the National Airspace System (NAS).

- This authority is being leveraged to grant case-by-case authorization for certain unmanned aircraft to perform commercial operations prior to the finalization of the Small UAS Rule, which will be the primary method for authorizing small UAS operations once it is complete.
- Process provides operators who wish to pursue safe and legal entry into the NAS a competitive advantage in the UAS marketplace, thus discouraging illegal operations and improving safety. It is anticipated that this activity will result in significant economic benefits. The FAA Administrator has identified this as a high priority project to address demand for civil operation of UAS for commercial purposes.

[https://www.faa.gov/uas/civil\\_operations/](https://www.faa.gov/uas/civil_operations/)

# Federal Aviation Administration (FAA): Regulations

- **Model aircraft operations**
  - Model aircraft operations are for hobby or recreational purposes only.
  - The FAA has partnered with several industry associations to promote the [Know Before You Fly](#) campaign to educate the public about using unmanned aircraft safely and responsibly.
    - Founded by the [Association for Unmanned Vehicle Systems International \(AUVSI\)](#), the [Academy of Model Aeronautics \(AMA\)](#), and the [Small UAV Coalition](#) in partnership with the Federal Aviation Administration (FAA) to educate prospective users about the safe and responsible operation of unmanned aircraft systems (UAS).
    - Prospective UAS operators want to fly, and fly safely, but many don't realize that, just because you can buy a UAS, doesn't mean you can fly it anywhere, or for any purpose. Know Before You Fly provides prospective users with the information and guidance they need to fly safely and responsibly.

[https://www.faa.gov/uas/model\\_aircraft/](https://www.faa.gov/uas/model_aircraft/) <http://knowbeforeyoufly.org/about-us/>



# Federal Aviation Administration (FAA): Regulations

- **Model aircraft operations**

- Individuals flying for hobby or recreation are strongly encouraged to adhere to the following safety guidelines:
  - Fly below 400 feet and remain clear of surrounding obstacles
  - Keep the aircraft within visual line of sight at all times
  - Remain well clear of and do not interfere with manned aircraft operations
  - Don't fly within 5 miles of an airport unless you contact the airport and control tower before flying
  - Don't fly near people or stadiums
  - Don't fly an aircraft that weighs more than 55 lbs
  - Don't be careless or reckless with your unmanned aircraft – you could be fined for endangering people or other aircraft

[https://www.faa.gov/uas/model\\_aircraft/](https://www.faa.gov/uas/model_aircraft/)

# Federal Aviation Administration (FAA): Regulations

- **Model aircraft operations**
  - Having fun means flying safely! Hobby or recreational flying doesn't require FAA approval, but you must follow safety guidelines. Any other use requires FAA authorization.

Hobby / Recreational Flying

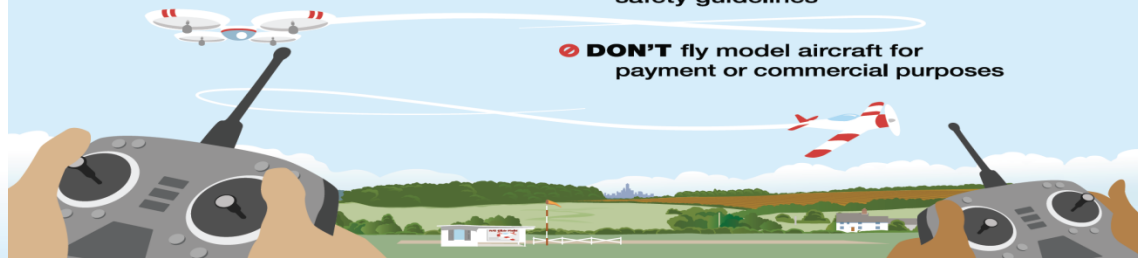
## What Can I Do With My Model Aircraft?

Having fun means flying safely! Hobby or recreational flying doesn't require FAA approval but you must follow safety guidelines. Any other use requires FAA authorization.

**AVOID DOING ANYTHING HAZARDOUS TO OTHER AIRPLANES  
OR PEOPLE AND PROPERTY ON THE GROUND**

**AVOID DOING ANYTHING HAZARDOUS TO OTHER AIRPLANES  
OR PEOPLE AND PROPERTY ON THE GROUND**

- ✓ **DO** fly a model aircraft/UAS at the local model aircraft club
- ✓ **DO** take lessons and learn to fly safely
- ✓ **DO** contact the airport or control tower when flying within 5 miles of the airport
- ✓ **DO** fly a model aircraft for personal enjoyment
- ✗ **DON'T** fly near manned aircraft
- ✗ **DON'T** fly beyond line of sight of the operator
- ✗ **DON'T** fly an aircraft weighing more than 55 lbs unless it's certified by an aeromodelling community-based organization
- ✗ **DON'T** fly contrary to your aeromodelling community-based safety guidelines
- ✗ **DON'T** fly model aircraft for payment or commercial purposes



[https://www.faa.gov/uas/publications/model\\_aircraft\\_operators/](https://www.faa.gov/uas/publications/model_aircraft_operators/)

North Carolina  
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# Federal Aviation Administration (FAA): Regulations

- **Model aircraft operations**

- The statutory parameters of a model aircraft operation are outlined in [Section 336 of Public Law 112-95 \(the FAA Modernization and Reform Act of 2012\)](#).
  - An individual who flies his/her UAS **within the scope of these parameters** does not require permission to operate a UAS
  - Any flight **outside these parameters** (including any non-hobby, non-recreational operation) requires [FAA authorization](#).
  - For example, using a UAS to take photos
    - **Recreational:** If for your personal use
    - **Non-recreational:** If for compensation or sale to another individual

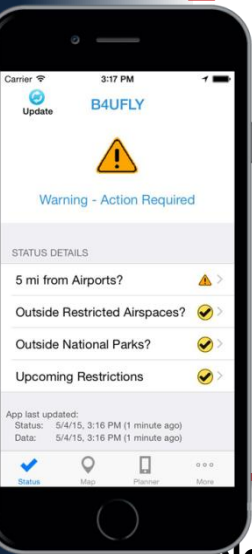
[https://www.faa.gov/uas/civil\\_operations/](https://www.faa.gov/uas/civil_operations/)

# FAA: B4UFLY Smartphone App

- B4UFLY is a simple, easy-to-use iOS smartphone app to determine whether there are any restrictions or requirements in effect at the location where a user wants to fly a UAV.
  - FAA plans to release the iOS app to ~1,000 beta testers during the summer of 2015 and then run the test for several months. Eventually, the agency will release the app to the general public and make an Android version.

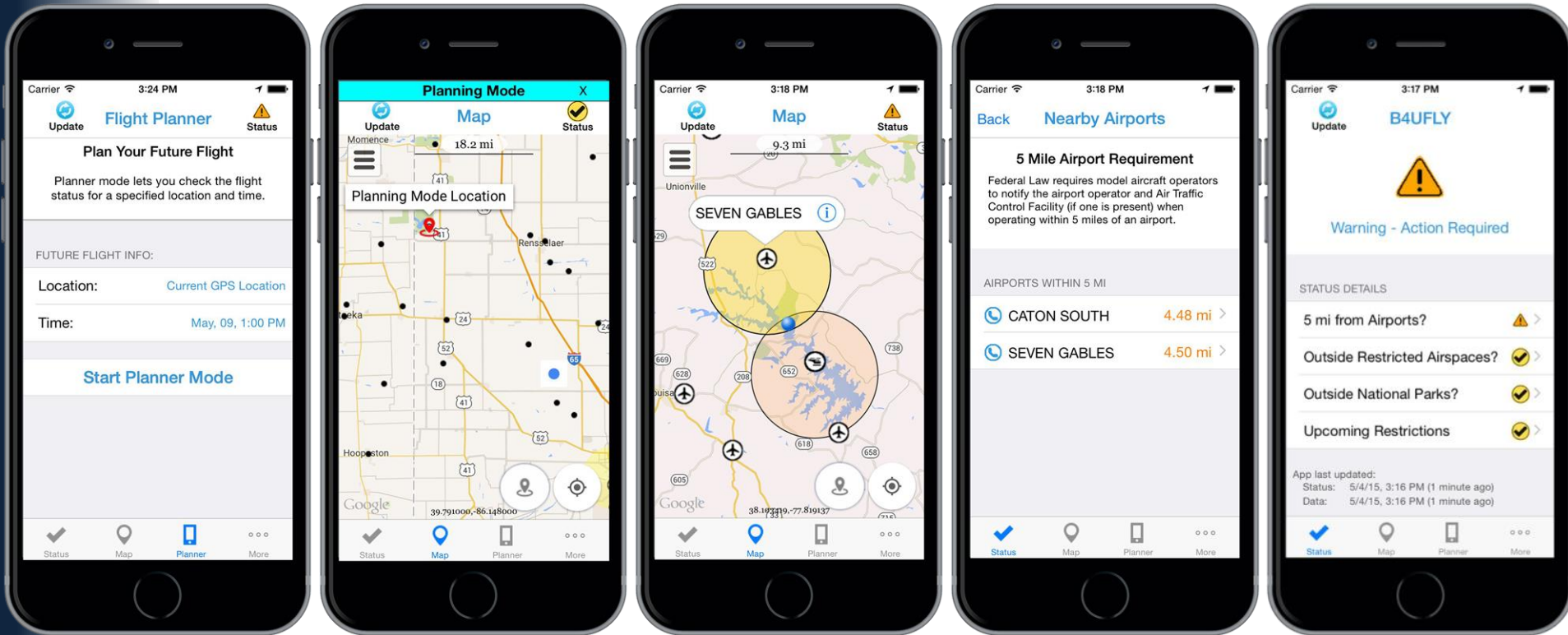
- Key features:

- A "Planner Mode" for future flights in different locations
- A clear "status" indicator that immediately informs the operator about his/her current or planned location. Information on the parameters that drive the status indicator
- Informative, interactive maps with filtering options
- Contact information for nearby airports
- Links to other FAA UAS resources and regulations



<http://www.faa.gov/uas/b4ufly/>

# FAA: B4UFLY Smartphone App



<http://www.faa.gov/uas/b4ufly/>

North Carolina  
Emergency Management



# NC UAS legislation

- Enacted as part of the Appropriations Act of 2014
  - Ratified by the NC General Assembly on 2 August 2014
  - Signed by Governor Pat McCrory on 7 August 2014

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- **SECTION 7.16.(e)** Until December 31, 2015, **no State or local governmental entity or officer may procure or operate an unmanned aircraft system or disclose personal information about any person acquired through the operation of an unmanned aircraft system unless the State CIO approves an exception specifically granting disclosure, use, or purchase.** Any exceptions to the prohibition in this subsection shall be reported immediately to the Joint Legislative Oversight Committee on Information Technology and the Fiscal Research Division. The following definitions apply in this section:
  - (1) **"Unmanned aircraft"** means an aircraft that is operated without the possibility of human intervention from within or on the aircraft.
  - (2) **"Unmanned aircraft system"** means an unmanned aircraft and associated elements, including communication links and components that control the unmanned aircraft that are required for the pilot in command to operate safely and efficiently in the national airspace system."

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- **§ 15A-300.1. Restrictions on use of unmanned aircraft systems.**
  - (b) General Prohibitions. – Except as otherwise provided in this section, **no person, entity, or State agency shall use an unmanned aircraft system to do any of the following:**
    - (1) **Conduct surveillance** of:
      - a. A **person or a dwelling** occupied by a person and that dwelling's curtilage **without the person's consent.**
      - b. **Private real property without the consent of the owner, easement holder, or lessee of the property.**
    - (2) **Photograph an individual, without the individual's consent, for the purpose of publishing** or otherwise publicly disseminating the photograph. **This subdivision shall not apply to newsgathering, newsworthy events, or events or places to which the general public is invited.**

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>



# NC UAS legislation

- **§ 15A-300.1. Restrictions on use of unmanned aircraft systems.**
  - (c) **Law Enforcement Exceptions.** – Notwithstanding the provisions of subsection (b) of this section, the use of unmanned aircraft systems by **law enforcement agencies of the State or a political subdivision of the State is not prohibited** in the following instances:
    - (1) **To counter a high risk of a terrorist attack** by a specific individual or organization if the United States Secretary of Homeland Security or the Secretary of the North Carolina Department of Public Safety determines that **credible intelligence indicates that such a risk exists.**
    - (2) **To conduct surveillance in an area** that is within a law enforcement officer's plain view when the officer is **in a location the officer has a legal right to be.**
    - (3) **If the law enforcement agency first obtains a search warrant authorizing the use of an unmanned aircraft system.**

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- **§ 15A-300.1. Restrictions on use of unmanned aircraft systems.**
  - (c) **Law Enforcement Exceptions.** – Notwithstanding the provisions of subsection (b) of this section, the use of unmanned aircraft systems by **law enforcement agencies of the State or a political subdivision of the State is not prohibited** in the following instances:
    - (4) If the law enforcement agency possesses reasonable suspicion that, under particular circumstances, **swift action is needed to prevent imminent danger to life** or serious damage to property, **to forestall the imminent escape** of a suspect or the **destruction of evidence, to conduct pursuit of an escapee or suspect**, or to facilitate the **search for a missing person**.
    - (5) **To photograph gatherings to which the general public is invited on public or private land.**

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- **§ 15A-300.1. Restrictions on use of unmanned aircraft systems.**
  - (d) Limitations on Use of Special Imaging Technology. – **Commercial and private unmanned aircraft systems may be equipped with infrared or other thermal imaging technology subject to the provisions of this subsection.** Infrared or other similar thermal imaging technology equipment shall be **for the sole purpose of scientific investigation; scientific research; mapping and evaluating the earth's surface, including terrain and surface water bodies** and other features; **investigation or evaluation of crops, livestock, or farming operations; investigation of forests and forest management; and other similar investigations of vegetation or wildlife.**

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- **§ 15A-300.1. Restrictions on use of unmanned aircraft systems.**
  - (e) **Any person who is the subject of unwarranted surveillance, or whose photograph is taken** in violation of the provisions of this section, **shall have a civil cause of action against the person, entity, or State agency that conducts the surveillance** or that uses an unmanned aircraft system to photograph for the purpose of publishing or otherwise disseminating the photograph. In lieu of actual damages, **the person whose photograph is taken may elect to recover five thousand dollars (\$5,000) for each photograph or video that is published** or otherwise disseminated, **as well as reasonable costs and attorneys' fees and injunctive or other relief as determined by the court.**

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- § 15A-300.1. Restrictions on use of unmanned aircraft systems.
  - (f) Evidence obtained or collected in violation of this section is not admissible as evidence in a criminal prosecution in any court of law in this State except when obtained or collected under the objectively reasonable, good-faith belief that the actions were lawful.

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

# NC UAS legislation

- **§ 63-95. Training required for operation of unmanned aircraft systems.**
  - (b) The **Division [Division of Aviation of the Department of Transportation]** shall **develop a knowledge and skills test for operating an unmanned aircraft system that complies with all applicable State and federal regulations and shall provide for administration of the test.** The Division may permit a person, including an agency of this State, an agency of a political subdivision of this State, an employer, or a private training facility, to administer the test developed pursuant to this subsection, provided the test is the same as that administered by the Division and complies with all applicable State and federal regulations.
  - (c) **No agent or agency of the State, or agent or agency of a political subdivision of the State, may operate an unmanned aircraft system within the State without completion of the test set forth in subsection (b) of this section.**

<http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=s744>

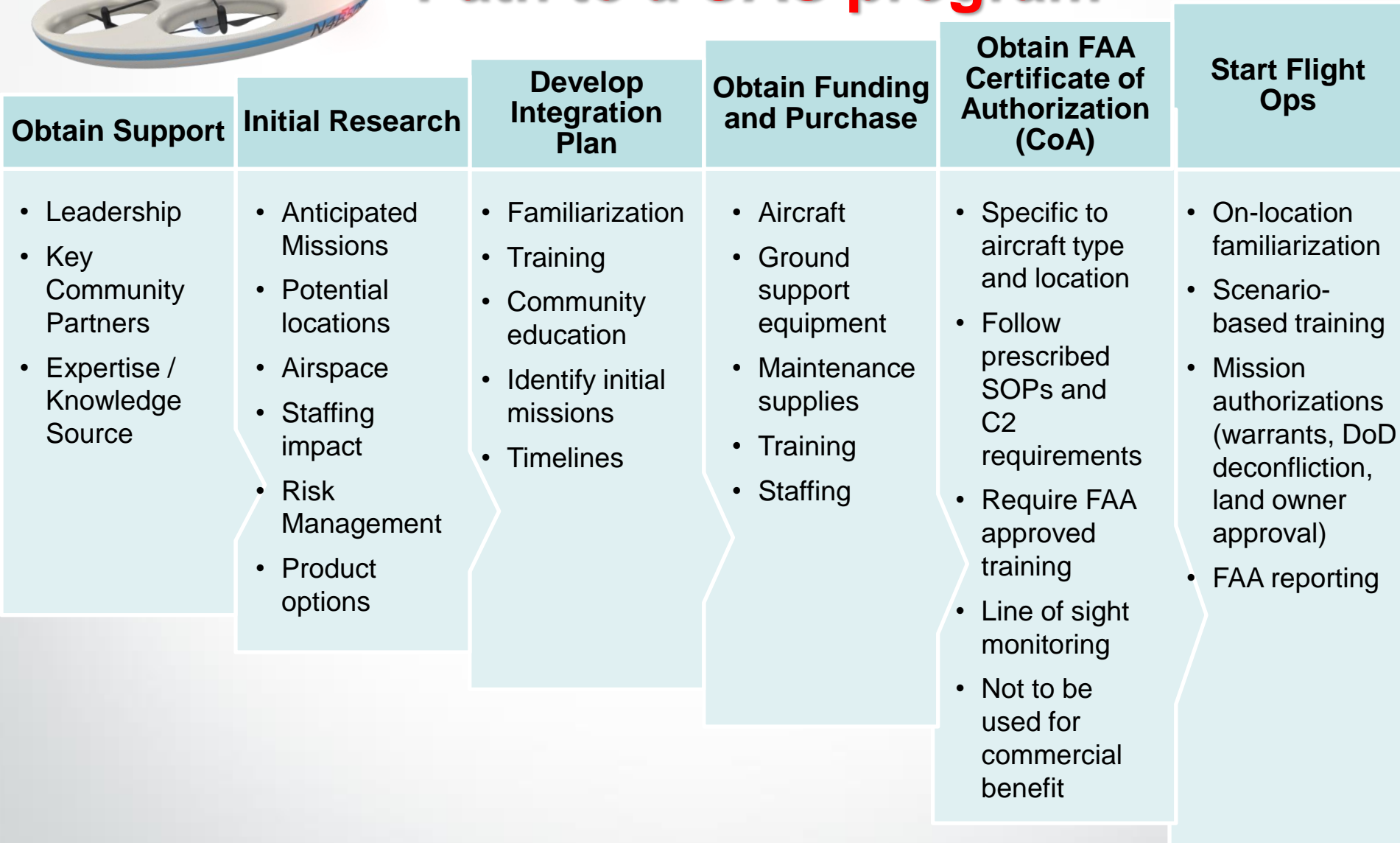


# NC UAS legislation

- **§ 63-96. License required for commercial operation of unmanned aircraft systems.**
  - (d) **The Division shall develop and administer a program to license operators of unmanned aircraft systems for commercial purposes.** The program must include the following components:
    - (1) A system for classifying unmanned aircraft systems based on characteristics determined to be appropriate by the Division.
    - (2) A fee structure for licenses.
    - (3) A license application process.
    - (4) Technical guidance for complying with program requirements.
    - (5) Criteria under which the Division may suspend or revoke a license.
    - (6) **Criteria** under which the **Division may waive licensure requirements for applicants currently holding a valid license to operate unmanned aircraft systems issued by another state** or territory of the United States, the District of Columbia, **or the United States.**



# Path to a UAS program



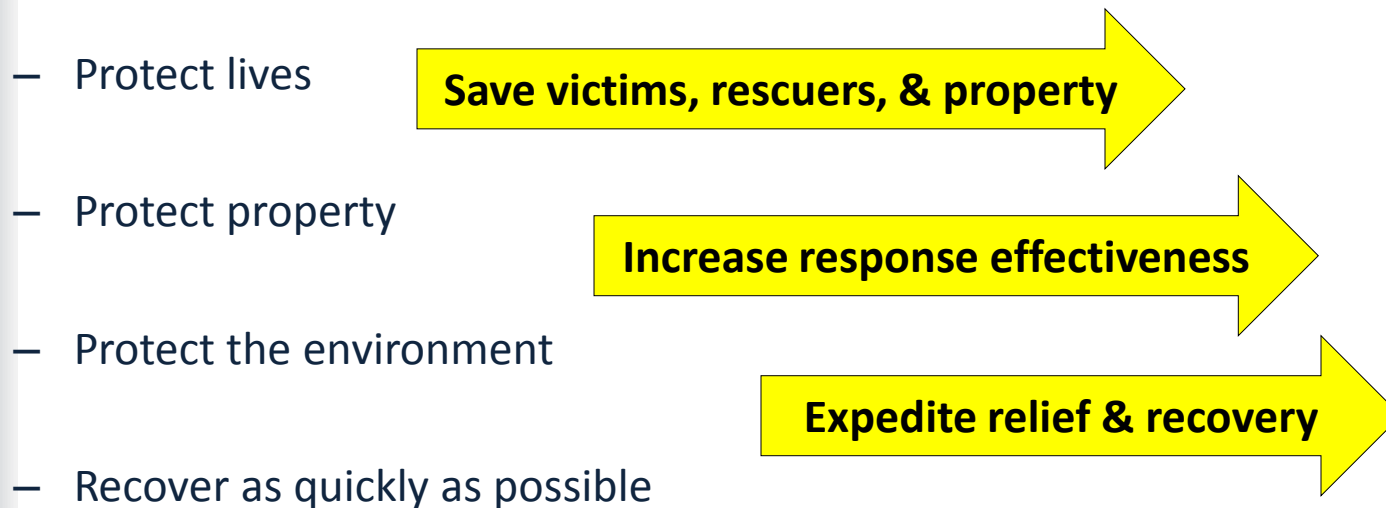
# Implementing UAVs in the NC Emergency Management (NCEM)

- NCEM is at the very beginning stages of implementing UAVs into its operations
  - Developed a UAV implementation plan
  - Researching UAV educational courses to get personnel up-to-speed in order to teach others
  - Created the following slides using material from:

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

# Implementing UAVs in the NC Emergency Management (NCEM)

- During any emergency or disaster the priorities for emergency responders and managers remain the same: **UAVs can help support these priorities:**



[https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key\\_Speeches-Reports-and-Presentations/2013\\_Key\\_Speeches/CA\\_Aerospace\\_Week\\_2013/Brewer-CAUAV2013.pdf](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

## 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

## Preparedness

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

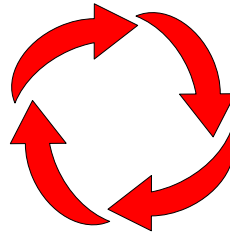
- **NC Floodplain Mapping Program (NCFMP)** determines flood hazard areas
- **Planning Operations** section assists communities to create an Emergency Operations Plan (EOP) (i.e. how to prepare for, respond to, and recover from a disaster)
- **Training & Exercise** branch conducts exercises and hosts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

## Response

Actions taken by emergency service personnel & agencies to save 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

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



# 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](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](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 save 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](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

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

# Conclusion

- UAVs can support all four phase of emergency response (Mitigation, Preparedness, Response, & Recovery)
- UAVs can save lives, property, and costs
- UAVs are a reasonably low cost solution for disaster communications capabilities & situational awareness

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# Conclusion

- UAVs will soon emerge into domestic emergency response and management
  - Thus, civil emergency response and management agencies need to learn more about the application and capabilities of all types of UAVs
  - We are rapidly approaching a time when it may be unethical to put humans in danger if UAVs can accomplish the same function

[https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key\\_Speeches-Reports-and-Presentations/2013\\_Key\\_Speeches/CA\\_Aerospace\\_Week\\_2013/Brewer-CAUAV2013.pdf](https://www.aiaa.org/uploadedFiles/About-AIAA/Press-Room/Key_Speeches-Reports-and-Presentations/2013_Key_Speeches/CA_Aerospace_Week_2013/Brewer-CAUAV2013.pdf)