The Role of Unmanned Aircraft in Transportation’s Future

Presentation for the
Pikes Peak Area Council of Governments

February 4, 2019
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TODAY’S TOPICS

• UAS Colorado Description

• The Range of Unmanned Aircraft Systems and current applications

• Challenges in using UAS in Transportation
  o Concerns regarding Safety
    ▪ Operations in Urban Areas
    ▪ Shared Airspace – NAS and Below 400ft
    ▪ Sense and Avoid Technologies
    ▪ Guarding Against Hijacking and Bad Actors
  o Concerns Regarding Privacy

• What Role will UAS Play in the Future of Transportation?
  o Optimization of Existing Transportation
  o More Public Safety / Emergency Applications
  o Routine use of UAS in Delivery
  o Unmanned Passenger Aircraft

• Colorado Advantages
UAS Colorado is a non-profit business league, committed to promoting the safe integration and use of unmanned aircraft systems for the benefit of the public.

Composed of commercial companies, universities, airports, first responders, economic development organizations, government representatives, etc.

- Advocate for public policy
- Create an industry identity for UAS in Colorado
- **Promote the safe, professional operation of UAS**
- **Conduct public awareness campaigns**
- Support Commercial, Government and Private Uses of UAS in Colorado
THE RANGE OF UNMANNED AIRCRAFT SYSTEMS

Drone is a commonly used word, but still perceived negatively, producing visions of:

- Unthinking
- Unfeeling
- Hostile
- Weaponized
- Flying Killer Robots
- Taking over the World
The Range of Unmanned Aircraft Systems

From

Micro UAS

To Commercial Grade UAS

Lockheed SR-72
- 100 feet long
- Operational speed of Mach 6
- Global circumnavigation in 6 hrs

To Mega UAS and Space Vehicles

To Hobby Aircraft
UNMANNED AIRCRAFT “SYSTEM” COMPONENTS

Airframes

Propulsion Systems

Payloads & Sensors

Launch Systems

Communication, Control Systems

Operators, Pilots

Recovery Systems

Automated Sense & Avoid Systems
CURRENT UAS APPLICATIONS

HB-17-1070 Study on Drone use by Public Safety Agencies
SB 19-020 Wildland Fire Airspace Patrol System

Search and Rescue

Infrared Cameras
Find Victims Fast

Disaster Survey
Accident Reconstruction

Fire Fighting

1. Analyzing Fuel Ahead of Fire
2. Monitoring Fire – Position & Progress
3. Monitoring Crews
4. Establish Communication Bridges to Crews
5. Fire Suppression (Water & Retardants)
   => Cost Savings of factor 10 or better!
6. Can Fly where manned Aircraft cannot
CURRENT UAS APPLICATIONS
Utilities and Infrastructure

Inspection of Railroads, Bridges & Structures

Detect Hot-Spots in Power-Lines

Detect Gas & Oil-Leaks
CURRENT UAS APPLICATIONS

Precision Agriculture

- Precision Use of Pesticides & Fungicides
- Precise Fertilization
- Precise Moisture Analysis and Irrigation
- Reduced Environmental Impact
- Significant Cost Savings
- Agricultural Spray and Analysis
CURRENT UAS APPLICATIONS

Forestry and Wildlife Management

Monitoring Snowpack and Water Levels

Avalanche Management
CURRENT UAS APPLICATIONS

Precision Surveying

Surveying and Precision Mapping
- Very High Accuracy
- Cost Savings
- Time Savings

Accurately Record Mining Progress

Landfill Volume/Area Calculation
- Selected Area: 38825 square meters
- Selected Volume: 54440 cubic meters
CHALLENGES USING UAS IN TRANSPORTATION

- Operations in Urban Areas
  - Concerns Regarding Safety
    - ✓ Shared Airspace – NAS and below 400ft
    - ✓ Sense and Avoid, Collision Avoidance Technologies
    - ✓ Guarding against Hijacking and Bad Actors
      - ❖ Hostile Drone Takeover
      - ❖ Counter-Drone Technologies

Manned Aircraft Below 400ft
- Emergency Medical Helicopters
- Aerial Firefighting
- Aerial Agriculture Application
- Utility Surveys
- Wildlife surveys
- Predator Control Operations
- Pipeline Surveys
- Law Enforcement Operations
- Military Training Flights
CHALLENGES USING UAS IN TRANSPORTATION

- Operations in Urban Areas
  - Concerns Regarding Privacy
    - Is My Home Safe?
    - Do I Have any Expectation of Privacy?
- Existing Criminal and Civil Laws Apply
**EXISTING CRIMINAL LAWS**

<table>
<thead>
<tr>
<th>Crime</th>
<th>Law</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criminal Mischief (C.R.S. § 18-4-501)</td>
<td>A person is guilty of criminal mischief if he or she knowingly damages real or personal property of another.</td>
<td>Class 3 misdemeanor (up to 6 months county jail and/or $50-750 fine) for damages less than $300 - Class 2 felony when damages $1 million or more (4-48 years in prison and/or $5,000-1,000,000 fine)</td>
</tr>
<tr>
<td>Criminal Trespass (C.R.S. § 18-4-503, 504)</td>
<td>A person is guilty of unlawful trespass when he or she unlawfully enters or remains on the land of another.</td>
<td>Class 2 or 3 misdemeanor (up to 12 months in jail and/or $250-1,000 fine), or class 1 petty offense (up to 6 months jail and/or fine up to $500), but higher if land zoned for agriculture</td>
</tr>
</tbody>
</table>

**Negligence**
People should exercise reasonable care when they act by taking account of the potential harm that they might foreseeably cause to other people.

**Reckless endangerment**
Conduct which creates a substantial risk of serious bodily injury to another person commits reckless endangerment, which is a class 3 misdemeanor.
# Existing Civil Laws

## Current Civil Remedies

<table>
<thead>
<tr>
<th>Tort</th>
<th>Law</th>
<th>Damages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trespass</td>
<td>One is liable for trespass if he enters the land or possession of another, or causes a thing to do so; this also includes throwing, propelling, or placing a thing on or under the surface, or in the air above the surface. <em>Gerrity Oil &amp; Gas Corp. v. Magness</em>, 946 P.2d 913, 933 (Colo. 1997);</td>
<td>Damages for reduction in value, cost to repair, possibly exemplary damages. <em>Evans v. Colorado Ute Elec. Ass’n</em>, 653 P.2d 63, 65 (Colo. Ct. App. 1982)</td>
</tr>
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WHAT ROLE WILL UAS PLAY IN THE FUTURE OF TRANSPORTATION?

➢ Optimization of Existing Transportation
➢ More Ubiquitous Use in Public Safety / Emergency Applications
➢ Routine use of UAS in Delivery
➢ Unmanned Passenger Aircraft
WHAT ROLE WILL UAS PLAY IN THE FUTURE OF TRANSPORTATION?

OPTIMIZATION OF EXISTING TRANSPORTATION

Identification of:
- Traffic Jams
- Accidents
- Weather-Related Issues
- Alternate Routes
- Plow and Maintenance Areas

Inspection / Assurance of a Healthier Transportation Infrastructure
WHAT ROLE WILL UAS PLAY IN THE FUTURE OF TRANSPORTATION?
MORE UBQUITOUS USE IN PUBLIC SAFETY / EMERGENCY APPLICATIONS

- Immediate 911 Response
- Routine / Integrated Use in Emergency
  Firefighting, Search and Rescue,
  Law Enforcement, Response
WHAT ROLE WILL UAS PLAY IN THE FUTURE OF TRANSPORTATION? ROUTINE USE OF UAS IN DELIVERY

Packaged Goods

Medicine to Rural Areas

Construction

Last Mile

Food
WHAT ROLE WILL UAS PLAY IN THE FUTURE OF TRANSPORTATION?
UNMANNED PASSENGER AIRCRAFT

Black Peak Engineering - Weasel

EHang 184 – Passenger Drone in Dubai

Passenger Drone
COLORADO IS THE LEADER IN UAS

• #1 Largest High Altitude COAs in the Nation
  - SLV – >5 million acres 15,000 ft MSL
  - Chaffee County 14,000 ft at 400 ft AGL
• #1 Most geographically diverse terrain in contiguous United States
• #1 Largest, long-standing UAS Law Enforcement Program – Mesa County
• #1 State in the Nation in COA square mileage awarded
  - CU Boulder – over 350,000 square miles
  - #2 is Kansas – 82,277 sq miles – the entire state
• #1 State in the Nation per capita in Aerospace employment
• The most BENEFIT to be gained – major wildland fires and floods
San Luis Valley – 8,100 Square Miles
Over 5,000,000 Acres – larger than Connecticut
Sean D. McClung
Chairman, Board of Directors
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Tel: 719-208-9244
Back-Ups
WHAT DO FAA STATUTES SAY ABOUT SAFE UAS OPERATIONS?

- Fly at or below 400 feet
- Keep your UAS within sight
- Never fly near other aircraft, especially near airports
  - Never fly over groups of people
  - Never fly over stadiums or sports events
- Never fly near emergency response efforts such as fires
- Never fly under the influence
- Don’t fly at night
- Be aware of airspace requirements
Before you fly outside you must:

- Register your UAS if it weighs more than 0.55 lbs and less than 55 lbs
- Label your UAS with your registration number
- Read and understand all safety guidelines

Registration costs $5 and is valid for 3 years

The FAA issues a unique registration number. These numbers must be visibly placed on the UAV or be inside a battery compartment or other place in the aircraft, provided no tools are needed to access

The UAS operator must carry a Certificate of Aircraft Registration (paper or electronic) and make it available to Law Enforcement upon request.

Failure to register a UAS, including Model Aircraft may result in regulatory and criminal sanctions. The FAA may assess civil penalties up to $27,500. Criminal penalties include fines of up to $250,000 and/or imprisonment for up to 3 years.
What Do FAA Statutes Say About UAS Operations?

Commercial and Other Non-Model Aircraft UAS Operations must be operated one of four ways

1) **14 C.F.R. Part 107**: As of Aug 29, 2016 certain small UAS can be operated for commercial and other non-hobby purposes

2) **Section 333 Exemptions**: 333 exemptions authorize commercial operations valid for two years. UAS operators must also obtain a Certificate of Waiver or Authorization (COA)

3) **Public Aircraft Operations**: Public aircraft operators must obtain a COA prior to operations. IAW Advisory Circular (AC) 00-1.1A, Public Aircraft Operations.

4) **Airworthiness Certification**: Some UAS are issued an airworthiness certificate that prescribes specific operational provisions for a particular aircraft inside an approved COA.
   
   21.191 Experimental category for the purposes of research and development, crew training, and market survey
   21.197 Production flight testing new aircraft

These flights must be conducted with an authorized aircraft (certificated or exempted), with a valid aircraft registration certificate and a properly certified pilot, abiding by established rules.
**What is our guidance to security and law enforcement?**

- Since Local Law Enforcement is not Federal, how are violations to Federal law handled?
  - In the same way as Federal drug law violations – prosecute, detain, refer

- OR – there are *a number of existing local laws that may have been broken* other than Federal
Basic Law Enforcement Response D.R.O.N.E.

Direct attention outward and upward, attempt to locate and identify individuals operating the drone. (Look at windows/balconies/roof tops).

Report incident to the FAA Regional Operations Center (ROC). Follow-up assistance can be obtained through FAA Law Enforcement Assistance Program special agents.

Observe the UAS and maintain visibility of the device, look for damage or injured individuals.
Note: Battery life is typically 20 to 30 minutes.

Notice features: Identify the type of device (fixed-wing/multi-rotor), its size, shape, color, payload (i.e., video equipment), and activity of device.

Execute appropriate police action: Maintain a safe environment for general public and first responders. Conduct a field interview and document ALL details of the event per the guidance provided by the FAA. www.faa.gov/uas/resources/law_enforcement/

Always follow agency policies – Take appropriate action based on the facts and circumstances of the incident and site/area-specific laws and rules. The FAA’s enforcement action does NOT impact ANY enforcement action/s taken by law enforcement.

Local ordinances that may apply include, but are not limited to: Reckless endangerment, criminal mischief, voyeurism, inciting violence.
FAA Drone Incident Reporting

Document and provide the following information to FAA:

- Identity of operators and witnesses (name, contact information)
- Type of operation (hobby, commercial, public/governmental)
- Type of device(s) and registration information (number/certificate)
- Event location and incident details (date, time, place)
- Evidence collection (photos, video, device confiscation)

Contact your FAA LEAP agent or an FAA Operations Center for assistance.

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<tr>
<th>FACILITY</th>
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<th>PHONE NUMBER</th>
<th>EMAIL</th>
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<tbody>
<tr>
<td>Western ROC</td>
<td>AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, WA and WY</td>
<td>425-227-1999</td>
<td><a href="mailto:9-WSA-OPSCTR@faa.gov">9-WSA-OPSCTR@faa.gov</a></td>
</tr>
<tr>
<td>Central ROC</td>
<td>AR, IA, IL, IN, KS, LA, MI, MN, MO, ND, NE, NM, OH, OK, SD, TX and WI</td>
<td>817-222-5006</td>
<td><a href="mailto:9-CSA-ROC@faa.gov">9-CSA-ROC@faa.gov</a></td>
</tr>
<tr>
<td>East ROC</td>
<td>AL, CT, FL, GA, KY, MA, ME, MS, NC, NH, PR, RI, SC, TN, VI and VT</td>
<td>404-305-5180</td>
<td><a href="mailto:9-ESA-ROC@faa.gov">9-ESA-ROC@faa.gov</a></td>
</tr>
<tr>
<td>East ROC</td>
<td>DC, DE, MD, NJ, NY, PA, VA and WV</td>
<td>404-305-5150</td>
<td><a href="mailto:9-ESA-ROC@faa.gov">9-ESA-ROC@faa.gov</a></td>
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WHAT IS OUR GUIDANCE TO SECURITY AND LAW ENFORCEMENT?
A CHECKLIST

• Find the Pilot
• If applicable, detain under existing local laws
• If not, ask to see their FAA UAS Registration
  • If there is no registration – they are flying illegally
  • If so, compare the N-number on the drone with their valid aircraft registration certificate and document
• Ask if they have been hired to fly the drone or if they are associated with a business
  • If yes, ask for their Part 107 remote pilot certification
  • OR, ask for their 333 Exemption and COA
  • If these are not present, they are flying a commercial operation illegally
• Check FAA safety guidelines and go through the safety issues. Flying over people is against Federal Statutes
• If statutes have been broken, call the 24/7 FAA Western Regional Operations Center
Successful enforcement depends on a factual report of the event. Law Enforcement officials, first responders, and others can assist the FAA and help deter unsafe UAS operations by:

(1) **Witness Identification, Interviews and Documentation of Observations**
(2) **Identification of Operators.** Registration information collected from the device
(3) **Viewing and Recording the Location of the Event.** Light and weather conditions, damage or injuries, number and density of people on the surface, fixed landmark identification to fix the position of the aircraft
(4) **Identifying Sensitive Locations, Events, or Activities, such as Temporary Flight Restrictions or Restricted Zones**
What Does the Law Say?

A Temporary Flight Restriction (TFR) is a type of Notices to Airmen (NOTAM). A TFR defines an area restricted to air travel due to a hazardous condition, a special event, or a general warning for the entire FAA airspace. The text of the actual TFR contains the fine points of the restriction.
Aug 29, 2016, the FAA released Part 107 of Chapter 14 of the Code of Federal Regulations

Part 107 became effective 29 Aug 2016

Prior to this, individuals and companies wanting to fly drones commercially had to apply for an exemption under the Section 333 provision of the FAA Modernization and Reform Act of 2012 — Waiver and COA required for each airframe / operation

Part 107 makes it much easier to establish commercial operations with UAS

The FAA estimates there could be as many as 600,000 drones used commercially within a year
**PART 107 GUIDELINES: OPERATIONAL LIMITATIONS**

- UAV must weigh less than 55 lbs. (25 kg)
- Visual line-of-sight (VLOS) only - unaided by any device other than corrective lenses
- May not operate over any persons not directly participating in the operation, not under a covered structure, and not inside a covered stationary vehicle
- Daylight-only operations, or civil twilight (30 min before official sunrise / after official sunset, local time) with appropriate anti-collision lighting
- Must yield right of way to other aircraft
- Max groundspeed of 100 mph (87 knots)
- Max altitude of 400 ft above ground level (AGL) or, if higher, remain within 400 ft of a structure
- Minimum weather visibility of 3 miles from control station
- First-person view camera can be used but does not satisfy “see-and-avoid” requirement
- Operations in Class B, C, D and E airspace are allowed with the required ATC permission
- Operations in Class G airspace are allowed without ATC permission
- No operations by a single pilot with more than one UAV at one time
**PART 107 GUIDELINES: OPERATIONAL LIMITATIONS**

- No operations from a moving aircraft
- No operations from a moving vehicle unless the operation is over a sparsely populated area
- No careless or reckless operations
- No carriage of hazardous materials
- Requires preflight inspection by the remote pilot in command
- No operations with physical or mental impairment that would interfere with safe operation
- Transportation of property for compensation or hire are allowed provided that
  - The aircraft, including its attached systems, payload and cargo weigh less than 55 pounds total;
  - The flight is conducted within visual line of sight and not from a moving vehicle or aircraft; and
  - The flight occurs wholly within the bounds of a State and does not involve transport (1) in and out of Hawaii (2) in and out of the District of Columbia or (3) in and out of a territory or possession of the United States
- Most of the restrictions above are waivable
PART 107 GUIDELINES: REMOTE PILOT IN COMMAND CERTIFICATION AND RESPONSIBILITIES

• Establishes a remote pilot in command position

• Operator must hold remote pilot airman certificate with a sUAS rating or be under the supervision of a person who does

• To qualify for a remote pilot certificate, a person must demonstrate aeronautical knowledge by either:
  o Passing an initial aeronautical knowledge test at an FAA-approved knowledge testing center; or
  o Hold a Part 61 pilot certificate other than student pilot, complete a flight review within the past 24 months, and complete the FAA sUAS online training course
  o Be vetted by the Transportation Security Administration
    o Be at least 16 years old

• Part 61 pilot certificate holders may obtain a temporary remote pilot certificate immediately upon submission of their application for a permanent certificate

• Other applicants will obtain a temporary remote pilot certificate upon successful completion of TSA security vetting. The FAA anticipates that it will be able to issue a temporary remote pilot certificate within 10 business days after receiving a completed remote pilot certificate application

• Until international standards are developed, foreign-certificated UAS pilots will be required to obtain an FAA-issued remote pilot certificate with a small UAS rating