

Insurance and the Rise of the Drones

Casualty Actuarial Society, Spring Meeting, Toronto
Anthony Mormino, Senior Legal Counsel, May 2017



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Rise of the Drones

Invasion of the Drones!

- FAA: Since 2016, 770,000 drones registered in US
 - That's more than double the number of manned aircraft.
 - 100,000 of those signed up in the last three months alone.
- Amazon is selling more than 10,000 drones a month
- The Future:
 - FAA: 2021 = 3.5 million hobbyist drones, 442,000 commercial drones
 - FAA: global drone sales could exceed \$90 billion in a decade, equating to 200,000 units sold each month.
 - Fully **autonomous** flight
 - Autonomous drone package delivery
 - First pilotless transport aircraft
 - The dawn of pilotless air taxi service



Bio Inspired Drones



Miniature Military Drones

Micro Drones



Super Micro Drones



The Application of Small Rotary-Wing Vehicles is Growing Rapidly



DJI Phantom 3
\$500 - \$1000

Parrot AR
\$250



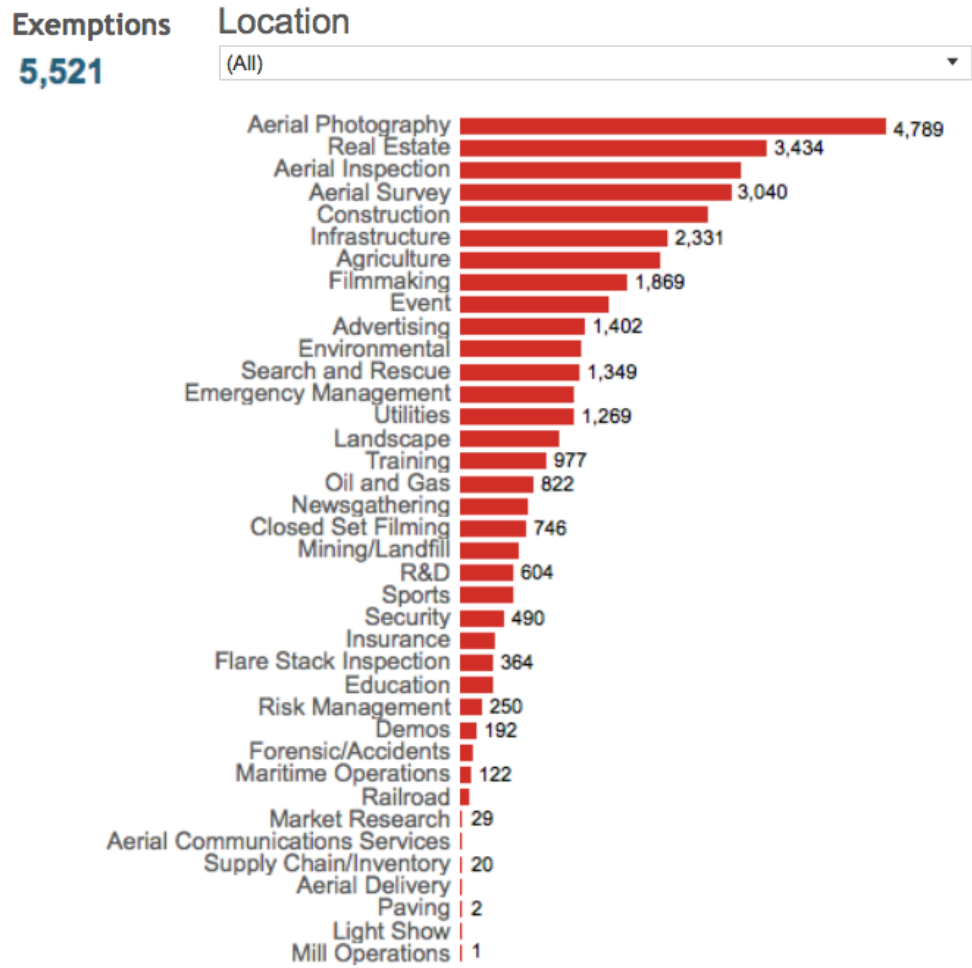
xFold Dragon X12 U11 \$32,000







Commercial Use of Drones (according to AUVSI)



Motion pictures

- Hollywood was first major commercial industry to receive limited licensing from the FAA to fly drones.
- Motion Picture Association of America ("MPAA") successfully applied for FAA exemptions on behalf of seven film companies for to fly drones for filming.
- MPAA argued that flying drones would be:
 - much safer than flying helicopters for aerial filming.
 - Keep filming in the U.S.
 - Movies like the Lord of the Rings Trilogy and James Bond, Skyfall, were shot outside of the U.S. with the use of drones.
- FAA exemptions for closed-set filming are becoming increasingly common.



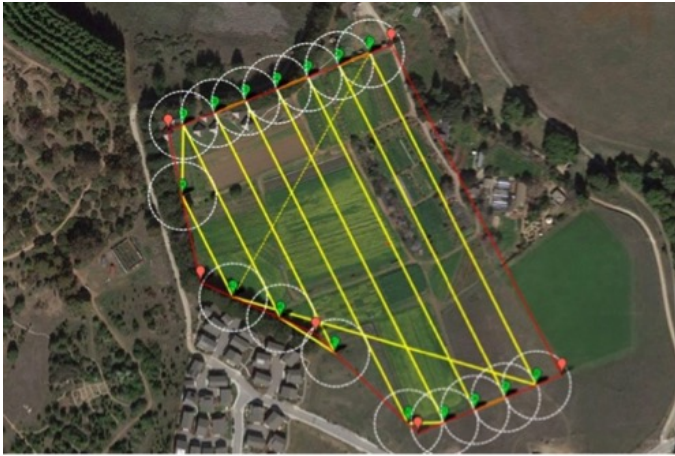
Real Estate



- Revolutionizing the ways properties are marketed
- Not for the amateur
- Insurance issues for agents are unclear
 - Are agents properly covered?
 - Operators coverage may not be sufficient
 - Who is liable if there is an accident?
 - Who is responsible for personal injury liability?

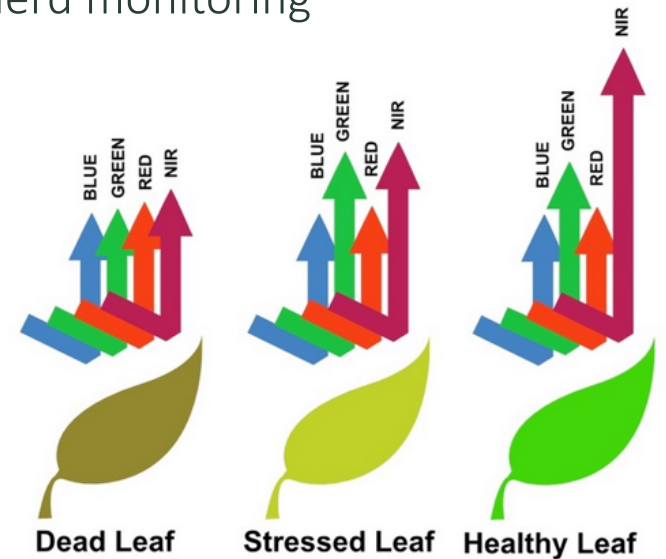
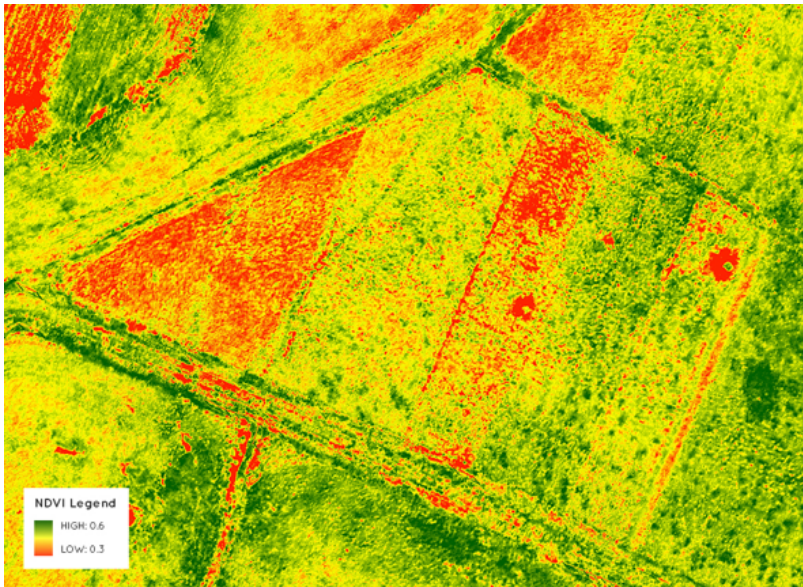
For example, a drone operator takes a picture of a home for a marketing brochure. The picture also includes part of the neighbor's backyard where teenagers are sunbathing. If the broker prints and distributes hundreds of copies of the brochure and the neighbor finds out, there could be a privacy violation and the neighbor could make a claim against the real estate practitioner

Agriculture



- Mid-season crop health monitoring
- Irrigation equipment monitoring
- Mid-field weed identification
- Variable-rate fertility
- Cattle herd monitoring

Mapping of fields on-demand

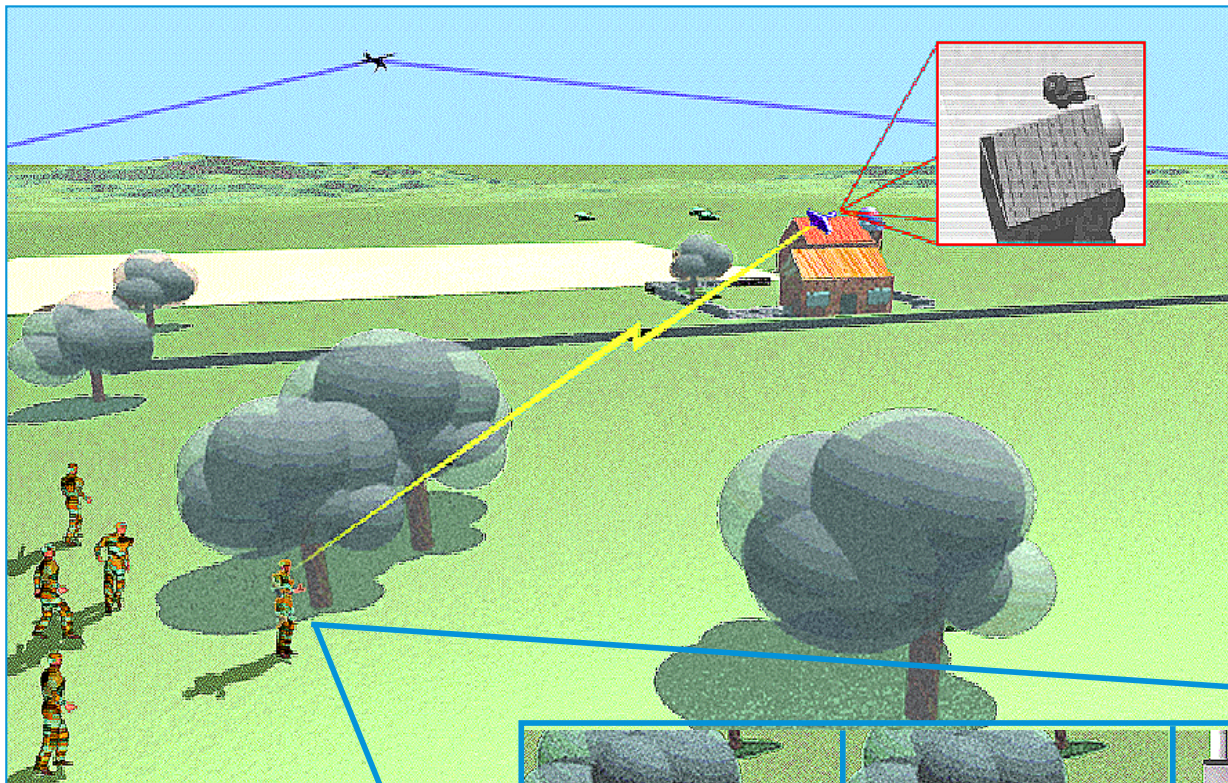


The basic principle of NDVI relies on the fact that, due to their spongy layers found on their backsides, leaves reflect a lot of light in the near infrared, in stark contrast with most non-plant object. When the plant becomes dehydrated or stressed, the spongy layer collapses and the leaves reflect less NIR light, but the same amount in the visible range. Thus, mathematically combining these two signals can help differentiate plant from non-plant and healthy plant from sickly plant.

(image courtesy Agribotix.com)

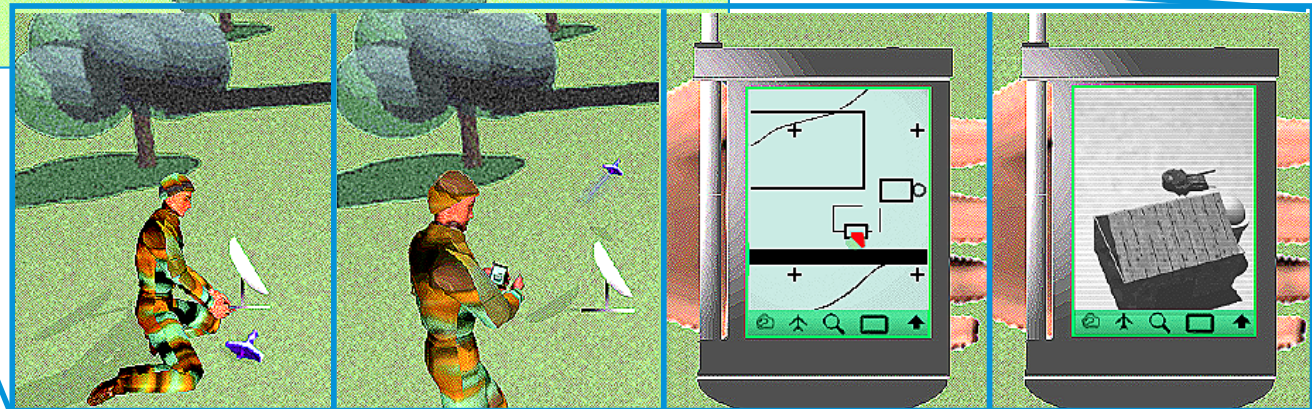
NDVI to measure density of vegetation

MAV Provides “Over-the-Hill” Reconnaissance (1999)



- 15 cm, Fully functional military air vehicles
- Local situational awareness for small units
 - Platoon level asset
 - Eliminates latency
- 30-60 minutes, 3-10 km
- Day/night imaging

Simplicity
Low cost
Soldier Proof

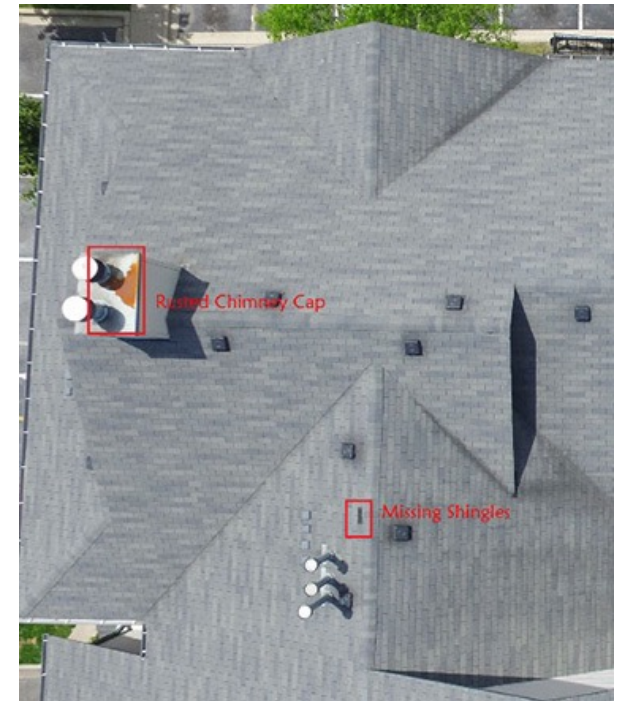
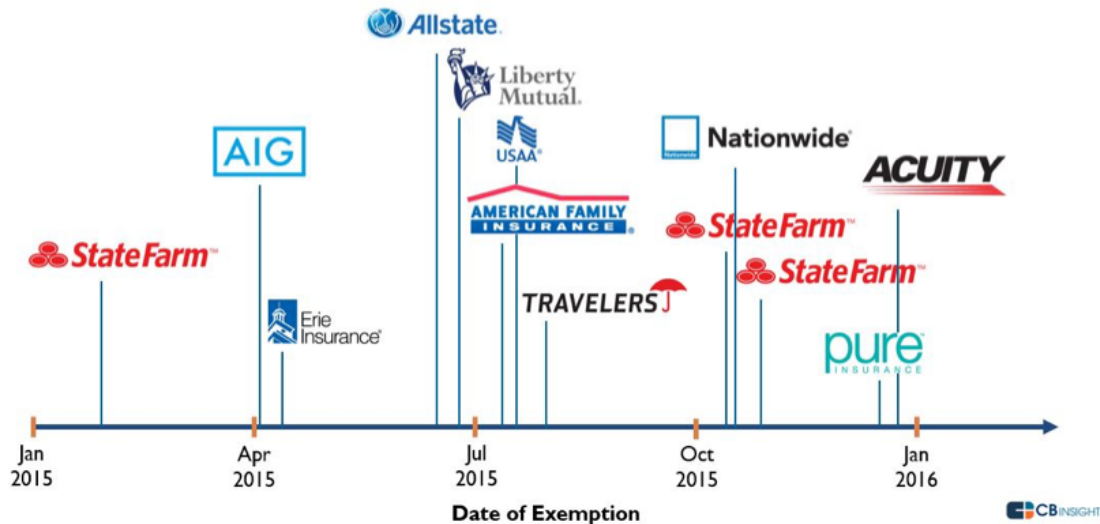


Insurance

- Drones can access roofing to estimate costs for repairs
- After a major wind storm, roofs can be drone inspected to prevent major damage to the inside
- Underwriting inspections of property – fast and timely



12 exemptions granted over the past year



Safety is the Key to Drone Law & Regulation



Drones are a federal affair

- US Supreme Court – *US v. Causby* - 1946
 - Airspace above US land is in the public domain
 - Flights over private land regulated by FAA
 - Flights over private land not a “taking” by the feds
- US federal government
 - Primary regulator of national airspace
 - All government, military and civilian purposes
 - **Federal Aviation Administration (FAA) 1958 – CAA, 1926**
 - “[t]here are no shades of gray in FAA regulations. Anyone who wants to fly an aircraft—manned or unmanned—in U.S. airspace needs some level of FAA approval”



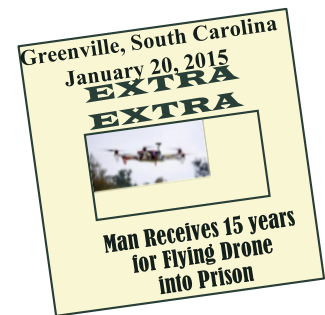
Main Goal of National Airspace Regulation: Keep the skies safe!

Drones Accidents: What can go wrong?



Reckless drone operation threatens national airspace safety

- 2015 alone, FAA received reports of over 1,200 close encounters with planes
- FAA worried about reckless drone operators!
 - Could a drone bring down a passenger plane?
 - Jan. 26, 2015 (3am) – Small drone crashes into tree on White House lawn
 - operator admits to Secret Service he lost control
 - Enter restricted airspace = violation of federal law
 - March 18, 2016: Lufthansa flight from Frankfurt approaching Los Angeles International Airport reported a drone flew about 200 feet above the Airbus A380!
 - March 28, 2016: Drone flown within 10 feet of Boeing 777 night landing at Heathrow
- Tests: Virginia Tech's CRASH Lab performed simulation, 8-pound quad-copter rotor flown into 9-foot diameter engine fan found on Boeing 777 and Airbus A380. Result: in less than 1/200th of a second, drone's destruction decimated fan blades and created an engine failure! Worry: engine cowling can't contain damage!



The Unmanned Systems Dilemma



- *Manned systems*

- Pilots of the vehicles assume both responsibility and risk



- *Unmanned systems*

Operators assume responsibility and public assumes the risk



- *Hobbyist systems*

Public assumes the risk and operator might not assume responsibility

DJI Phantom 3 drone hit a Quebec woman in the head

Engadget 24 June 2016



- 2.7-pound DJI Phantom 3 drone falls
- Hits woman on head, causing whiplash
- Operator was flying without a permit, and too close to a crowd

CA offers \$75,000 to catch firefighter-interrupting drone pilots

Engaget 30 Jun 2015



- Officials in California's San Bernardino County are tired of drones grounding their airborne firefighting efforts.
- Aerial firefighters reportedly came across five hobby drones flying over the affected areas that ultimately forced them to land.
- The 20-minute delay those drones caused was apparently enough for the flames to spread to the Interstate 15 freeway, burning cars in the process.

Stanford U. – Drone crash causes fire near campus lake, prompts evacuations

Stanford Daily 3 Jun 2015



- The unmanned aerial vehicle (UAV) belonged to the a nonprofit student team, Uplift Aeronautics
- It crashed during a routine test flight and caused a battery fire
- Stanford University has since banned all flying

Drone Law & Regulation



1st Point to Consider: Drone rules are changing!

Everything is new!

- Modern drones are new, operators are new, the law is new
- Most countries' aviation laws didn't originally contemplate public use of drones
- Problem: Law is catching up to technology



FAA's new rules for commercial use, lowers the bar

- Old Rules: Section 333 exemption, drone operators required to have pilot's license!
- New rules: Effective August 29, 2016
- Lead to new era in US in which UAS flights become common!
- Huerta: "Most flexible regime for small drones in the world"

TODAY



FAA's New Drone Rules: 14 CFR Part 107

*Effective August 29, 2016

Pilot Requirements:

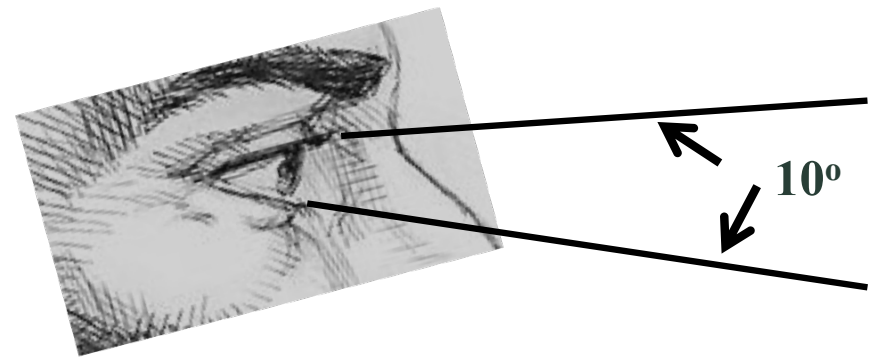
- Must be at least 16 years old
- Pay \$150, pass an aeronautical knowledge test at FAA-approved testing center
- Background check by the Transportation Safety Administration (TSA)

Aircraft Requirements:

- Less than 55 lbs.
- Must be registered

Operating Rules:

- Class G airspace:
 - "uncontrolled" airspace near the ground everywhere except controlled airspace around airports.
 - **Flights near airports & heliports – 5 miles – with a tower require prior permission**
- Must keep the aircraft in sight (visual line-of-sight)
- Must fly under 400 feet
- Must fly during the day
- Must fly at or below 100 mph
- Must yield right of way to manned aircraft
- Must NOT fly over people
- Must NOT fly from a moving vehicle



FAA Requires Registration of Recreational & Comm'l Drones

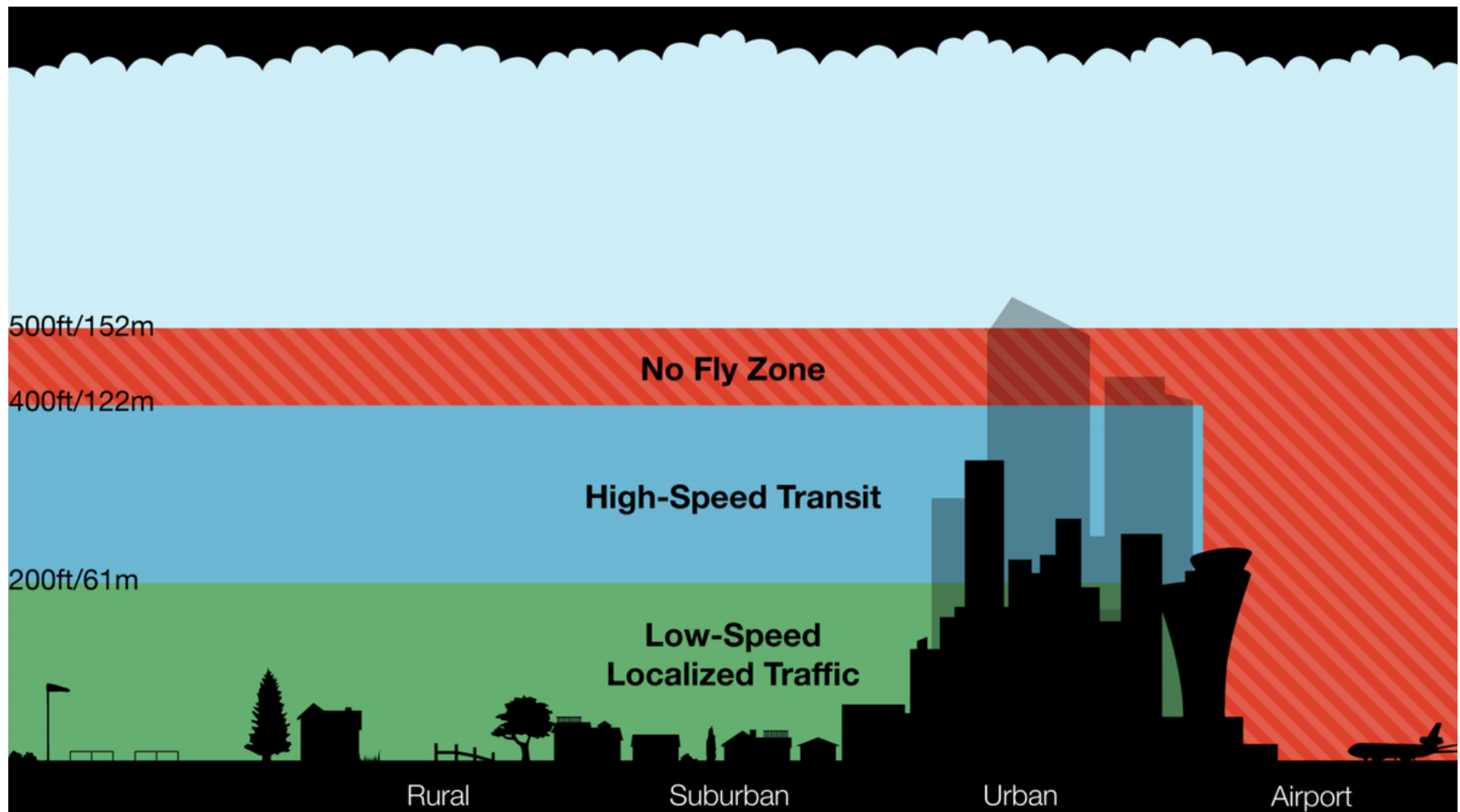
- Started 2016
- Registration on-line, \$5 for each non-hobby drone, \$5 for entire fleet of hobby drones, good for 3 years
- FAA issues registration number to be marked on drones' hulls
- Goal: forcing owners to register drones will make them think twice about responsibility to fly safely, could be held accountable for an accident.
- Penalty for failure to register: **FAA interim rule says may “result in civil penalties up to \$27,500. Criminal penalties for failure to register can include fines of up to \$250,000 . . . and/or imprisonment up to 3 years.”**
 - Enforcement: FAA v. local police departments?



Waivers to Rule 107 Requirements

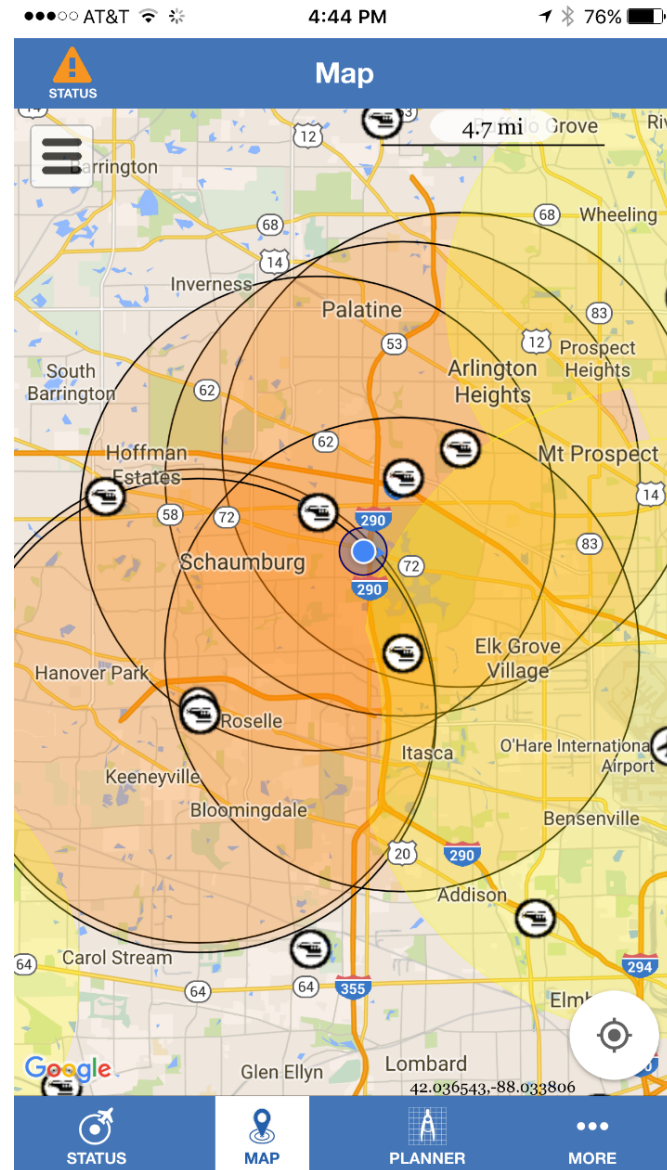
- Apply for a certificate of waiver, approve *if the FAA finds that the proposed operation can be performed safely*. Only certain elements of Rule 107 can be waived:
 - Operation from a moving vehicle or aircraft
 - *Daylight operation* - First day rules in effect, FAA already granted 76 exemptions, most of them to companies that want to fly drones at night.
 - Visual line of sight aircraft operation
 - Visual observer
 - Operation of multiple small unmanned aircraft systems
 - Operation over people
- **Drones more than 55 pounds at takeoff?** Use Section 333 exemption process (pilot's license required)
- **Government entities** or organizations (e.g. law enforcement agencies, public universities, state governments, local municipalities)
 - Fly in compliance with Rule 107, or
 - Obtain a blanket public Certificate of Waiver or Authorization (COA)

Filling the skies with drones



Flying a drone away from other aircraft can be complicated!

Schaumburg, Illinois



“airports” include actual airports, regional, municipal, & commercial + hospital and police “heliports”

Source: FAA
iOS app,
B4UFLY

Drone Regulation in Other Countries



- Do you need permission from Transport Canada to fly?
 - No permission required:
 - Recreational use + less than 35 kgs/77lbs
 - Commercial use + less than 25kgs/55lbs (exceptions where SFOC needed)
 - SFOC required:
 - Recreational use + more than 35kgs/77lbs
 - Commercial use + more than 25kgs/55lbs
- **New safety regs proposed March 2017!**



- Mainland Europe operates under the jurisdiction of the European Aviation Safety Agency (EASA),
- Need certification in any situation
- Certification granted on a case-by-case basis
- Requests proposing flight in unpopulated areas usually approved



- Brazil a leading player in UAV use: Uses UAVs to patrol its borders
- No laws that cover civilian use



- No Civil Aviation Authority regulations on UAV users
- Government encourages UAV use
- UASs used to monitor drug trafficking and university research.



- UASs have been in use since 1980
- Mainly agricultural purposes –response to aging farming population
- Vast majority of crops are sprayed using unmanned helicopters and drones



- 20 kg (or 44 pounds) – considered “small unmanned aircraft”
- Need “Permit to Fly” classification, relatively easy to acquire
- If heavier or used for aerial photography requires a “Permit to Carry Out Aerial Work;” has tougher restrictions
- Pilot qualification, design & construction certificates.



- An “Unmanned Aircraft System” profit-seeking “air work,” has requirements including pilot certification, but relatively easy to meet
- “model aircraft, flown for sport & recreation and education,” which essentially are not regulated (except VFR required)

UAV Safety



You're responsible to use your unmanned aircraft safely and legally

Always:

- Fly during daylight and in good weather (not in clouds or fog).
- Keep your aircraft in sight where you can see it with your own eyes.
- Make sure your aircraft is safe for flight before take-off.
- Know if you need permission to fly and when to apply for a Special Flight Operations Certificate.
- Respect the privacy of others – avoid flying over private property or taking photos or videos without permission.

Do not fly:

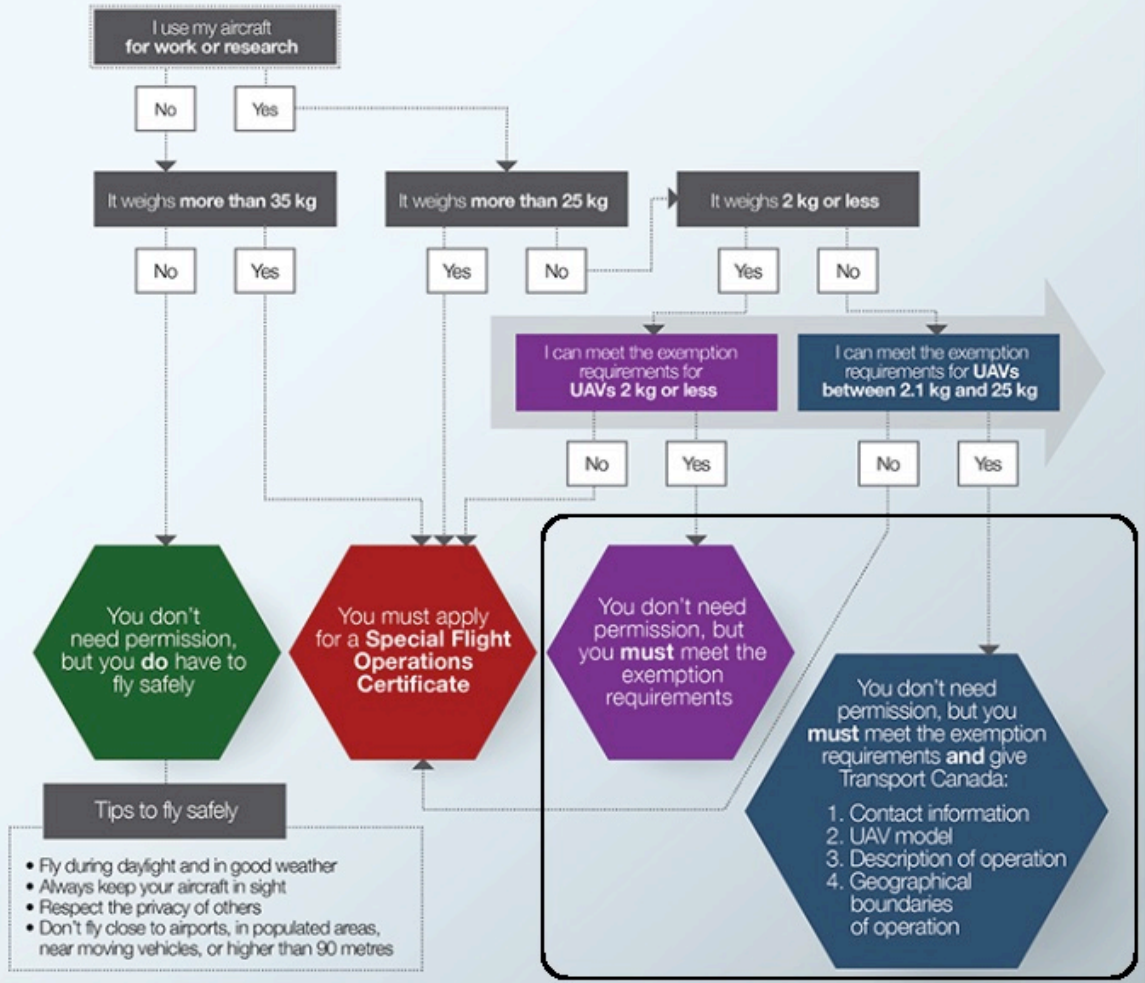
- Closer than ^{5 mi} 9 km from an airport, heliport, or aerodrome.
- Higher than 90 metres. 300 ft
- Closer than 150 metres from people, animals, buildings, structures, or vehicles. 500 ft
- In populated areas near large groups of people – such as beaches, sporting events, outdoor concerts, festivals, or firework shows.
- Near moving vehicles – avoid highways, bridges, busy streets or anywhere you could endanger or distract drivers.
- Within restricted airspace, including near or over military bases, prisons, and forest fires.
- Anywhere you may interfere with first responders.



Permission Matrix



Flying an unmanned aircraft? You may need permission from Transport Canada



No permission needed as long as . . .



Exemption requirements for operating UAVs without permission

THIS INFOGRAPHIC IS FOR EASE OF REFERENCE ONLY. YOU MUST CONSULT THE OFFICIAL EXEMPTIONS.

UAVs 2 kg or less

- Be safe, well trained and know the rules of the sky
- Be 18 years old, or at least 16 years old to conduct research under academic supervision
- Have at least \$100,000 liability insurance
- Be alert—not tired or under the influence of alcohol or drugs
- Inspect your UAV and site before flight to ensure they are safe
- Get permission before you go onto private property
- Inform Air Traffic Services if your UAV enters controlled airspace
- Give right-of-way to manned aircraft
- Fly during daylight and in good weather
- Keep your aircraft in direct line of sight and always be able to see it with your own eyes
- Verify that radio frequencies/transmissions won't affect control of your UAV
- Have an emergency plan ahead of time
- Carry a copy of your UAV exemption, proof of liability insurance, contact information, and aircraft system limitations
- Follow the manufacturer's operating and emergency procedures, including those if the remote control loses contact with the aircraft
- Respect laws from all levels of government
- Operate only one UAV at a time, with a single remote control
- Immediately stop all operations if you can no longer meet the exemption requirements or if the safety of a person, property or other aircraft is at risk
- Stay at least 30 metres away from people, animals, buildings, structures, and vehicles not involved in the operation

UAVs between 2.1 kg and 25 kg

- Be safe, well trained and know the rules of the sky
- Be 18 years old
- Have at least \$100,000 liability insurance
- Be alert—not tired or under the influence of alcohol or drugs
- Inspect your UAV and site before flight to ensure they are safe
- Get permission before you go onto private property
- Carry a copy of your UAV exemption, proof of liability insurance, contact information, and UAV system limitations
- Respect laws from all levels of government
- Keep your UAV in direct line of sight and always be able to see it with your own eyes
- Operate only one UAV at a time, with a single remote control
- Give right-of-way to manned aircraft
- Fly during daylight and in good weather (no clouds, snow or icy conditions)
- Create and follow procedures for landing and recovering your UAV and for contacting emergency responders and air traffic control.
- Have an emergency plan ahead of time
- Follow the manufacturer's operating and emergency procedures, including those if the remote control loses contact with the aircraft
- Verify that radio frequencies/transmission and electronic devices won't affect control of your UAV
- Assess the risk of losing connection with the UAV and decide when to use the flight termination setting
- Have a fire extinguisher on site
- Inform Air Traffic Services if your UAV enters controlled airspace
- Follow the manufacturer's maintenance/assembly instructions
- Ensure the UAV does not have an emergency locator transmitter
- Report accidents to Transport Canada and stop operations until you have addressed the risks
- Immediately stop all operations if you can no longer respect the exemption requirements or if the safety of a person, property or other aircraft is at risk
- Stay at least 150 metres away from people, animals, buildings, structures, and vehicles not involved in the operation

DO NOT:

- Fly closer than 9 km from forest fires, airports, heliports, aerodromes, or built-up areas
- Fly over military bases, prisons or in controlled or restricted airspace
- Fly over crowds or higher than 90 metres
- Participate in special aviation events, air shows or system demonstrations
- Carry dangerous goods or lasers

Drone Insurance Legal Issues

Insurability: Potential legal issues raised by use of drones



- Violating FAA Rules
 - Fines can be very large – *Do insurers want to cover?*
 - Injunction stopping use – *Do insurers want to pay for lost income?*
 - Ex. § 336 FMRA requires recreational drone operators give notice to airports within 5 miles of use. Will every model aircraft user comply every time?
- Physical damage and bodily injury
 - What if your drone crashes into property or people on the ground? – *Most want this coverage*
 - State tort laws may impose liability, negligence and strict liability
 - BUT drone strikes a passenger plane? Loss could be in the tens of millions! – *How much coverage?*
- Nuisance
 - Depending on drone size, noise or kicking up dust onto neighbor's property
 - Interfere in neighbor's use of property = lawsuit for nuisance – *Do insurers want to cover this tort?*
- Trespass
 - State laws prohibiting drone use over private property without owner consent, private cause of action *Do insurers want to cover this tort?*
 - Some states prohibit use of drone to capture of image with intent of surveillance
 - Property boundaries may sometimes be difficult to notice for a drone operator

As of May 2017

38 states, 168 bills



36 states have laws

Insurability: More potential legal issues in use of drones

- **Invasion of privacy**
 - By private individuals:
 - Some states passed laws forbidding photos or video by drones (TX, ID, MO) *Do insurers want to cover this tort?*
 - Reasonable expectation of privacy then publication?
 - Abuse by law enforcement/gov't:
 - US 4th Amendment, unreasonable searches - *Do insurers want to cover this tort?*
 - Some US states require police to obtain search warrant to gather criminal evidence by drone
 - New draft US federal privacy rules introduced Feb 2015 for gov't & private use
- **Stalking and harassment**
 - Drones could be used by criminal voyeur or stalker and in harassment by paparazzi
- **Wiretap laws**
 - Drone could be used to intercept oral communications
 - Commercial microphones can record sound up to 300 feet away
 - Could violate federal (criminal) wire tap statutes
- In sum: Simple to operate, but quietly create complicated legal prob insurance companies



Trespass: Where does private property end and public airspace begin? *The Causby Case – a “govt taking”*

- Guidance: US. v. Causby (1946)
- Causby family lived on property, raised chickens
- US military rented neighboring property as landing strip for large aircraft, landing planes flew directly over Causby property
 - Closest flight was 83 feet over property: 67 ft. above home, 18 feet above trees
 - Causby family constantly subjected to noise and light, day and night
 - Had to give up chicken business (too many died, spooked, flew into walls)
 - Causby argued government “took” his property, owed family \$ for the taking
 - Government claimed flights in public airspace, no trespass so no taking
- Court ruled for Causby: government *effectively* took over land, reduced value: nuisance (interfere enjoyment, use) = gov’t trespassed, interfered substantially with Causby use of land
 - Court: “landowner owns at least as much of the space above ground as he can occupy or use in connection with the land”
 - Owns even if doesn’t use in traditional sense, does use for purpose of light and air (wind)
 - Invasion of that space by air isn’t traditional trespass but is in “the same categories as invasions of the surface.”
 - Same result: Guith v. Consumers Power (Mich. 1940)(built towers that interfered w/airport)

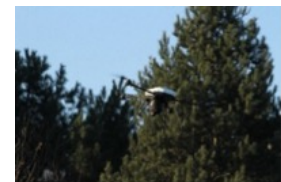


Trespass: Where does private property end and public airspace begin? *Unclear today!*

- Causby court: Lowest reaches of airspace in public domain BUT **excludes** “immediate reaches above the land.”
- FAA regulates “navigable airspace”
 - Until recently, navigable airspace generally above 500 feet for traditional aircraft
 - BUT low flying drones are “aircraft” and navigate below 500 feet = drones turn airspace below 500 feet into navigable airspace
- **FAA position: has authority over airspace from tips of grass up to highest reaches of national airspace**
 1. Congress gave FAA power to regulate “the airspace necessary to ensure safety of aircraft and efficient use of airspace.” 49 USC § 40103(b)(i) = **FAA can regulate airspace at any altitude!**
 2. Congress gave FAA authority to issue regulations, standards, methods that FAA “finds necessary in air commerce and national security.” 49 USC § 44701 (a) = **FAA can regulate below 500 feet!**
 3. Congress gave FAA authority to issue rules on “flight of aircraft for navigating, protecting, identifying aircraft” and “protecting individuals and property on the ground” 49 USC § 40103(b)(2) = **FAA can regulate non-navigable air**
- **Conflict: Private property rights vertically *versus* regulated public airspace**
 - FAA: Limited enforcement resources, modifies position on complete preemption
 - Laws traditionally in police power of state or local gov’ts NOT preempted
 - EX: Land use, zoning, privacy, trespass, and law enforcement operations
 - Created a space in which state and local gov’ts could enact drone laws
- **BUT what happens when private property owner interferes with drone flight above private property? Courts will have to resolve!**

Trespass: Where does private property end and public airspace begin? *Boggs v. Meredith*

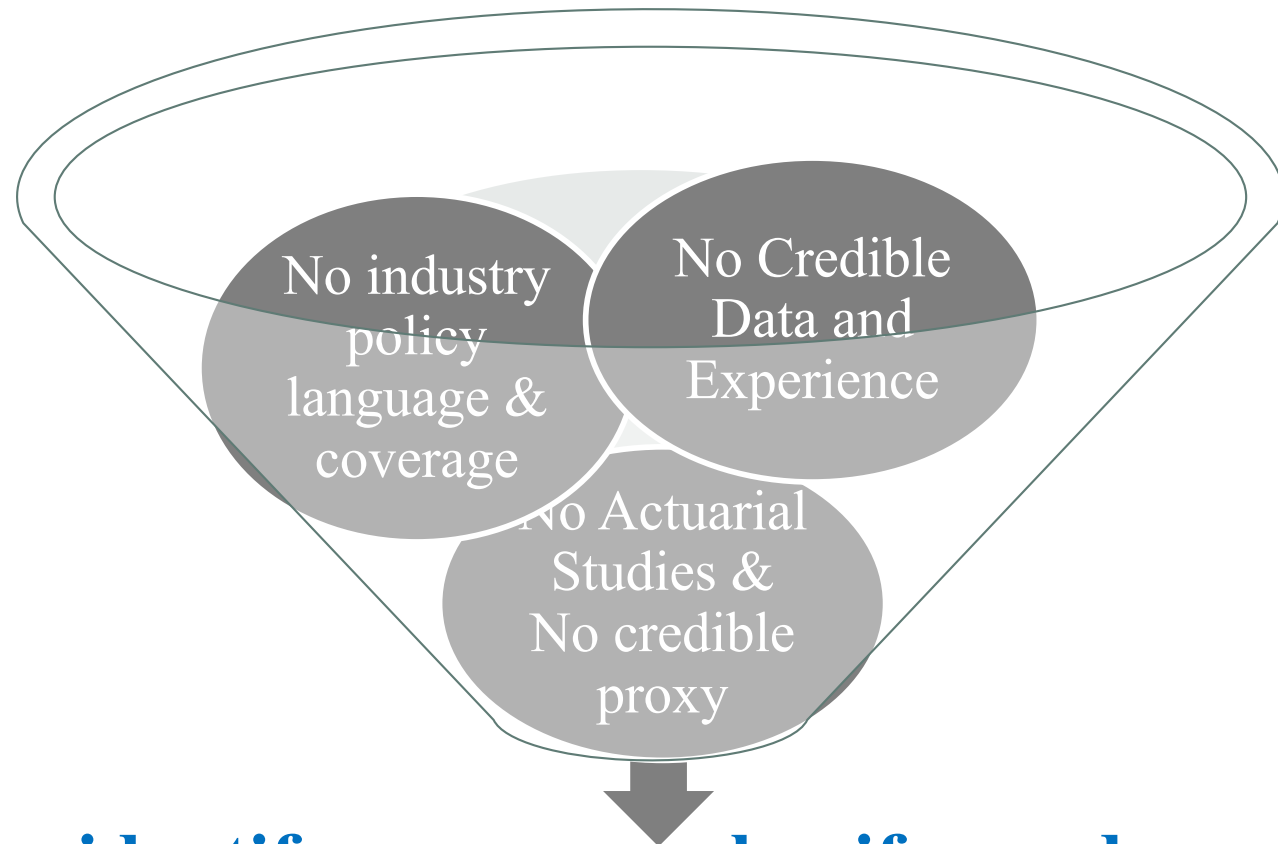
- **July 2015** – Kentucky: W. Meredith man shoots drone hovering allegedly above backyard
 - Meredith arrested, criminal mischief, Judge dismisses saying had right to shoot drone for trespass and invasion of privacy
 - Drone operator J. Boggs Court said drone was 200 feet up, pictures of landscape only
 - **Argues no trespass because was in public airspace**
 - **No invasion of privacy because no expectation when outside, seen from air**
 - **Shooting unlawful violation of federal law, is felony to shoot down an “aircraft”**
 - **Who is right?** Where did Meredith’s vertical property end and public domain begin? In which space was Bogg’s drone at 200 feet up?
 - If 200 feet is in public domain, no trespass, Meredith no right to shoot, **Boggs wins**
 - If 200 feet up was part of Meredith’s property, Bogg’s trespassed, **Meredith wins**
 - Case dismissed, judge decided for state court not federal.
 - *Boggs v. Meredith*, W. Dist. KY, Jan 2016 (3:16-cv-00006)



Drone Insurance Trends



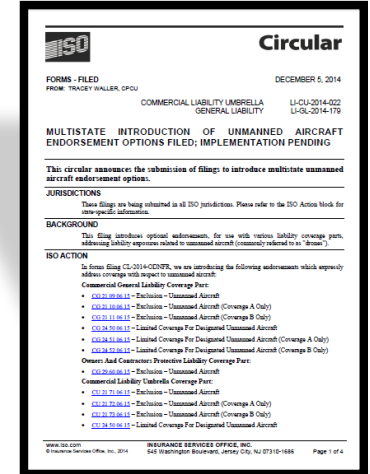
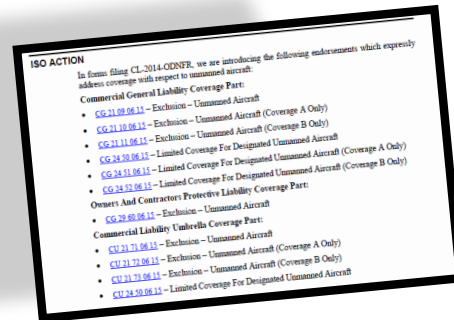
Drone emerging risk challenges...both qualitative and quantitative for insurers



How do you identify, measure, classify, and price the drone risk with credibility? Too unique and no historical data

ISO drone endorsements effective June 1, 2015 - Generally

- Endorsements specifically to deal with coverage of risks associated with drones, provide “underwriting flexibility” in addressing drone related risks
- Endorsements to
 - Commercial Liability Umbrella policies, and
 - General Liability Policies
- 12 exclusions
- 6 provisions for “limited coverage”
- New term: drone = “unmanned aircraft” = aircraft not designed to be controlled directly by a person from within or on the aircraft
- Options
 - (1) **Exclude liability** not precluded by policy with respect to unmanned aircraft, or
 - (2) An exception to exclusions for UA **specifically designated** in a schedule to the policy BUT ONLY FOR **designated operations or projects**
- Interesting: No requirement that drone operator have FAA Part 107 permission!



Insurance Underwriting Information

- Qualification of pilot(s)
 - Appropriate FAA licenses?
- Extent of training and experience of the drone's operator?
- Will there be more than one operator?
- Intended use of the drone? Where will you operate it?
- Storage of drone
- Is drone purchased for insured's own use
- Original cost new with copy of receipt and evidence of date purchased
- Manufacturer, model #, serial #
- Description of how drone will be used by insured, specific projects?
- Will the drone carry a payload? What type and what is the max weight?
- Plans in case you lose communication with the drone?



Insurance coverage under drone hull policies

- No credible rates because the exposure is so new
- What deductible to charge: dollar amount or percent of value
- What perils are covered or not covered and other issues:
 - damage to drone from collision in air?
 - damage to drone from take-off or landing?
 - theft?
 - bigger exposure for high schools
 - damage arising out of an inexperienced or unqualified operator?
 - replacement cost or ACV
 - how do drones depreciate in value and what is market values for used drones
 - what is cost to repair a drone and who does the repair?
- Time element coverages?
 - Does insured use drone to perform work for others for a fee?



Who is selling drone insurance coverage in the US?

- Most major insurance companies have been waiting for the FAA to issue its drone rules for commercial use
 - Many commercial users do not have the FAA's required authorization
 - **Aviation brokers**: Aerial Pak, Avalon Risk Management, Aviation Insurance, Aviation Insurance Resources, AVION Insurance, Driessen Assuadeuren, Harpenau Insurance Agency, Kinney Pike Insurance, SkySmith, Skyvuze, Sutton James Incorporated, Transport Risk Management, UAV Protect, Unmanned Risk Management, Verifyly.
 - **Insurers**: AIG, Global Aerospace, Lloyd's
 - New rules: FAA Expects 600,000 Commercial Drones In Air Within A Year
 - FAA: 7 million in the sky by 2020
 - Commercial insurance policy for a DJI Phantom covering liability up to \$1 million can run as little as \$800-\$1000 a year.
- = Market for insurance approximately \$600M 2016-2017, & by 2020 \$7 billion.

Takeaways



- **Fully leveraged, drone use in underwriting and claims has big benefits**
 - Cut audit or adjustment costs – send multiple drones to multiple risks, not people
 - Reduce risks to people – no ladders on roof tops, no adjusters in dangerous areas
 - Provide better data and insight – get big picture aerial views, infra-red data
- **Drone insurance = completely new market for insurance products**
 - Potential new source of business
 - Currently no limits on which type of insurers can write, so open to all
 - Sell as stand alone
 - Sell as add on to existing products
- **Drone highways and Drones as a Service**
- **Drones present big potential risks but also big potential rewards!**

Questions?





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