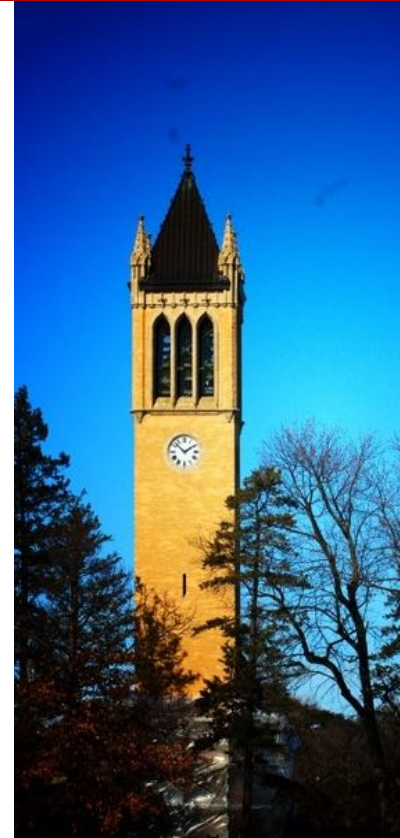


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2016 Casualty Loss Reserve Seminar Insurance and Drones

Rich Wlezien
Professor and Chair
Department of Aerospace Engineering



Drones: Past, Present, and Future



Global Hawk



Reaper



Naval UCAV



NASA Ikhana



Bio Inspired
Drones



Miniature
Military
Drones

Micro
Drones



Mosquito
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

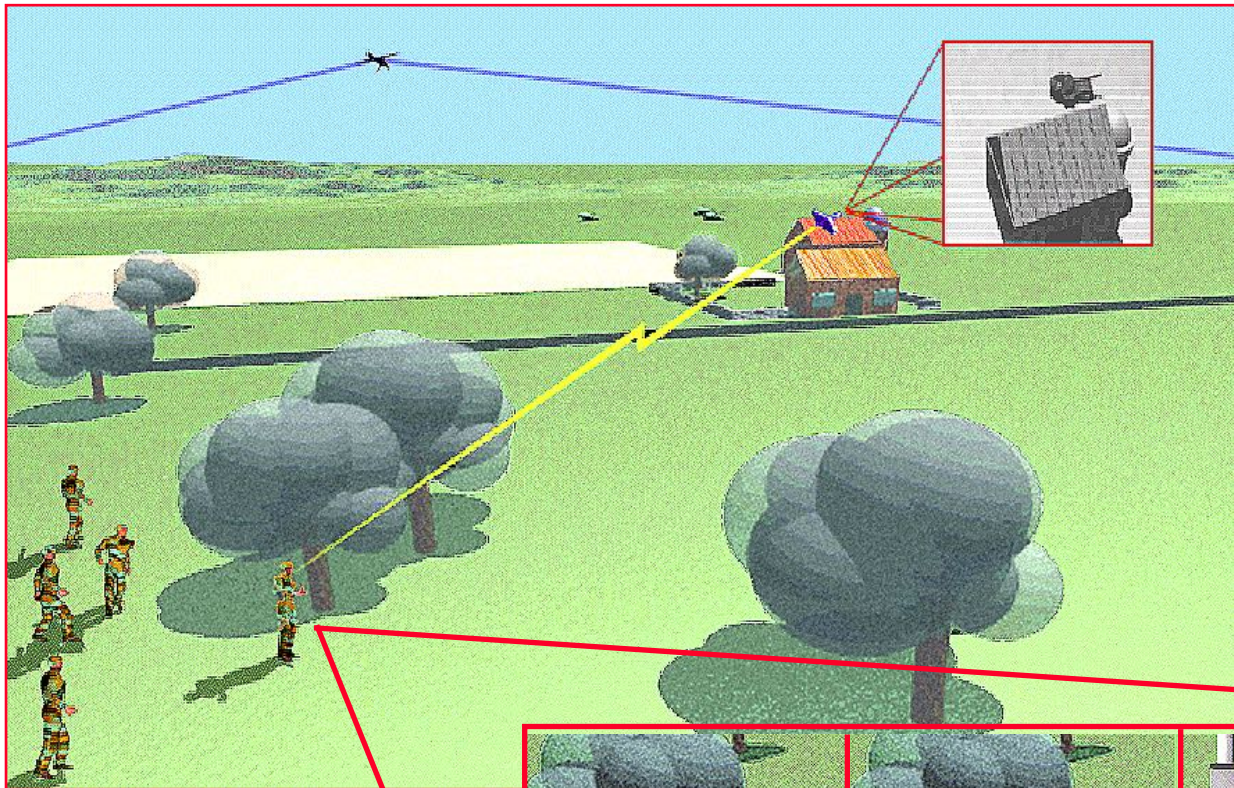


Some Recent History...



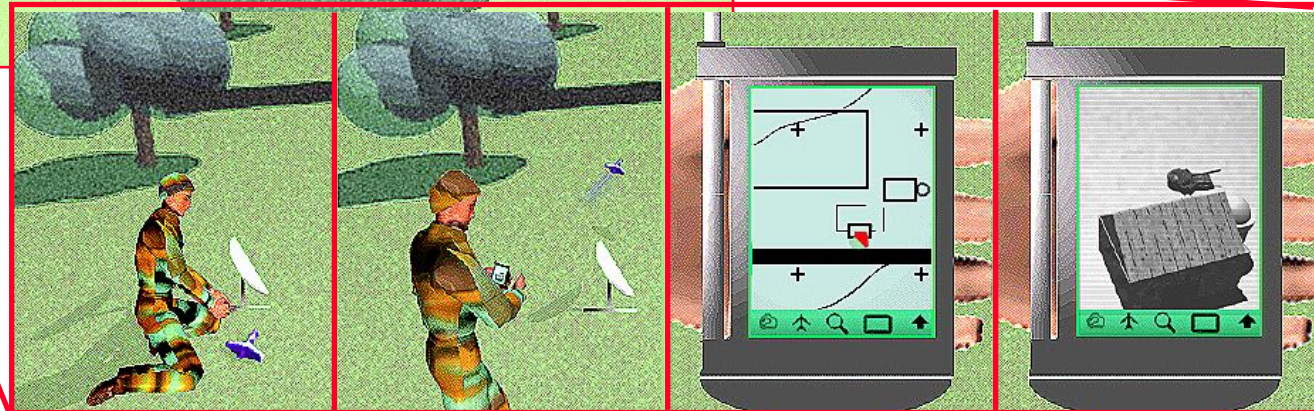


MAV Provides “Over-the-Hill” Reconnaissance (1999)



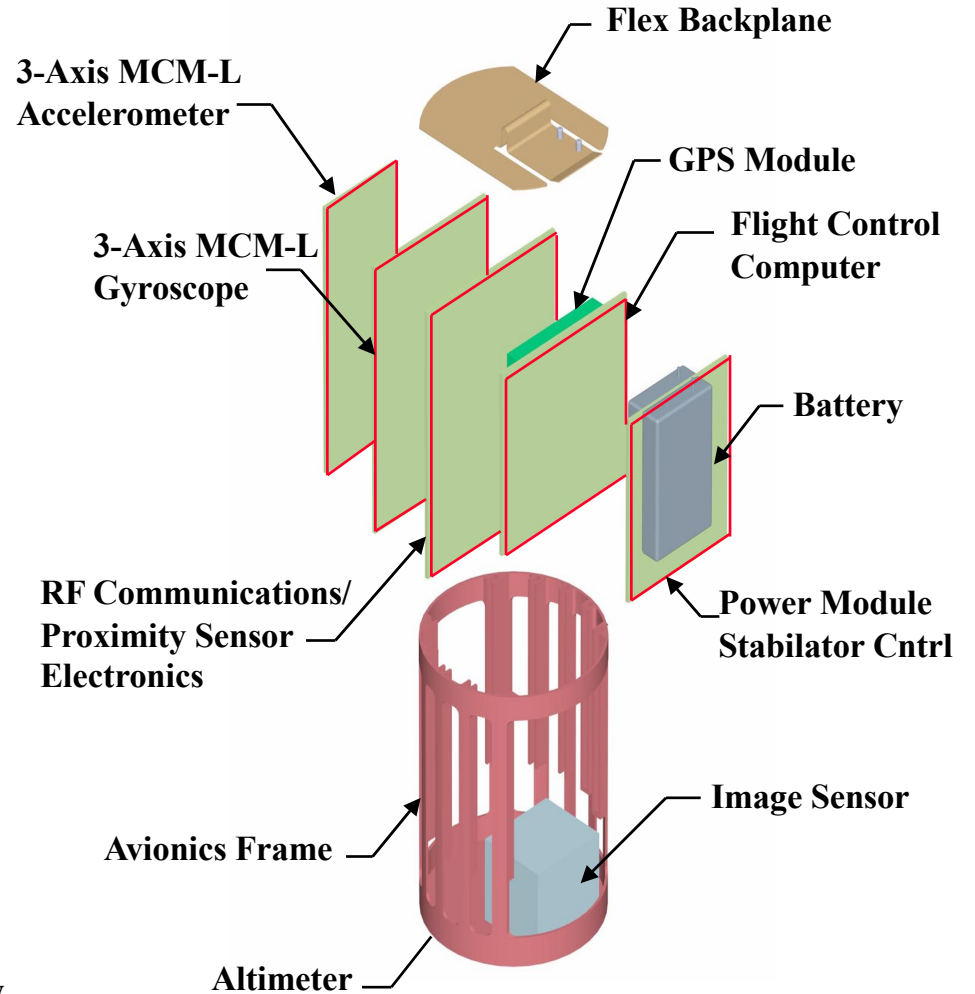
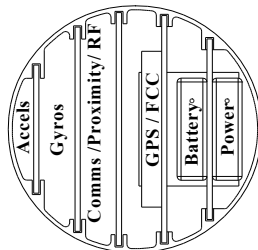
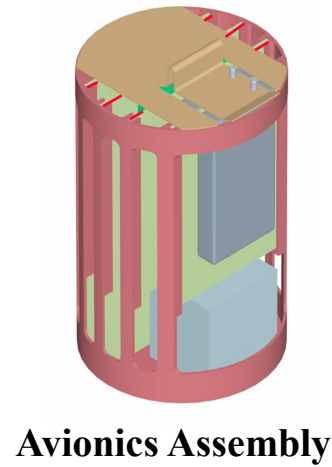
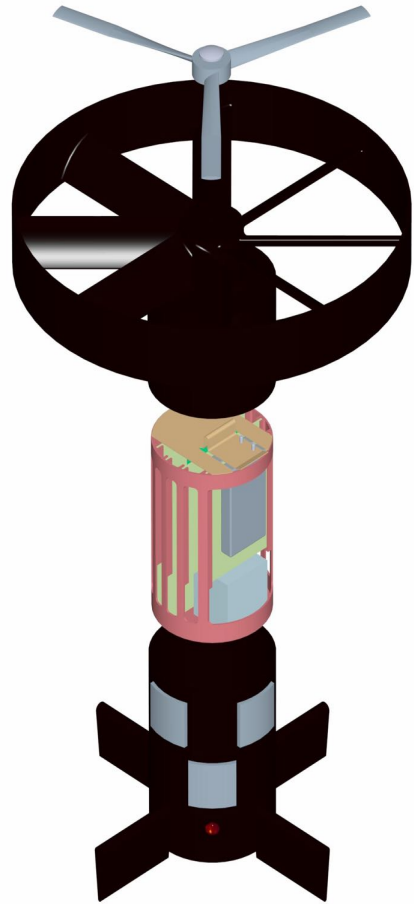
- **15 cm, Fully functional military air vehicles**
- **Local situational awareness for small units**
 - **Platoon level asset**
 - **Eliminates latency**
- **30-60 minutes, 3-10 km**
- **Day/night imaging**

Simplicity
Low cost
Soldier Proof

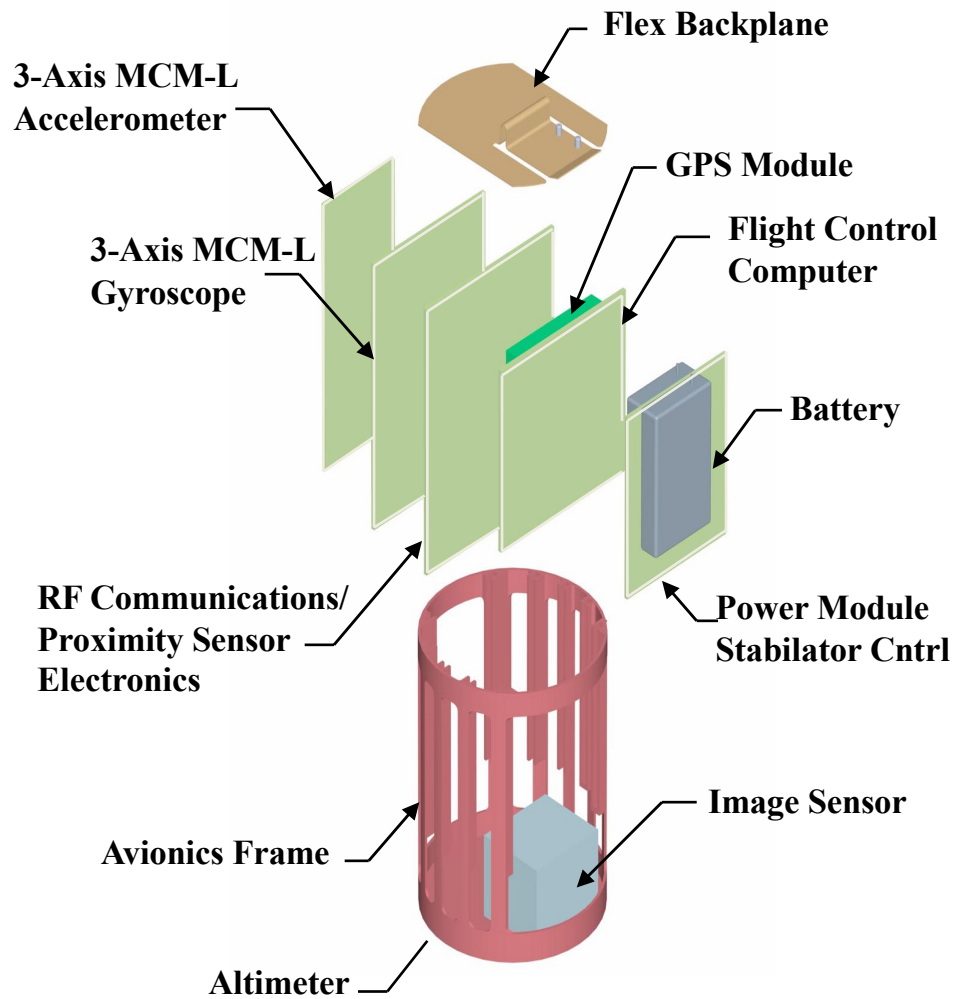




Draper Autonomous Navigation System



1999



2015



Commercial Use of Drones

Exemptions
3,136

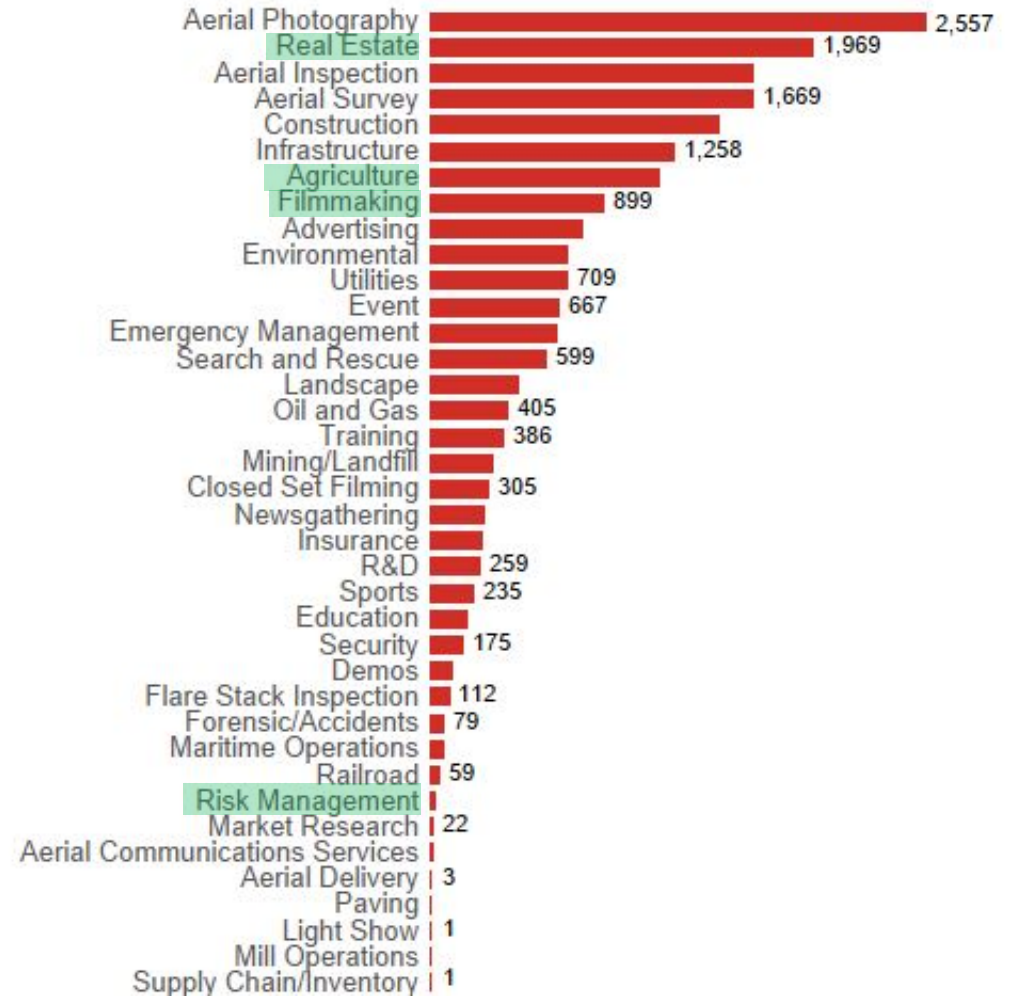
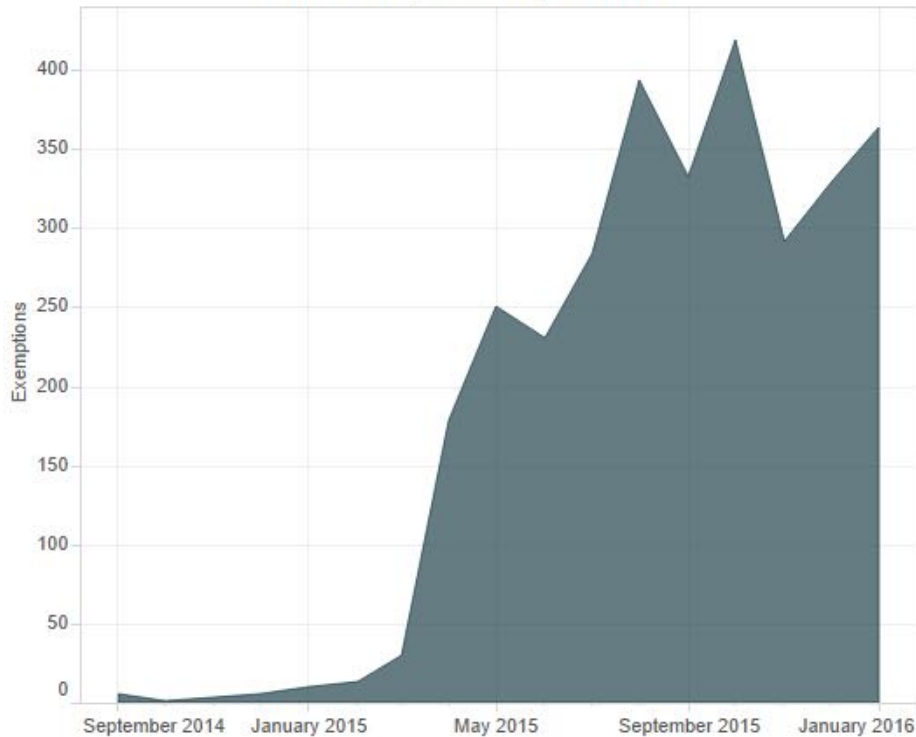
Location
All

Exemptions
3,136

Location
All

Application(s)
All

UAS Exemptions by Month



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

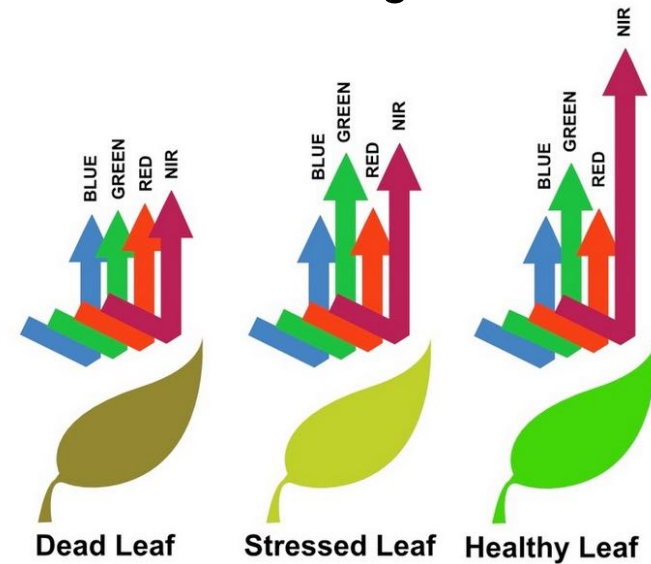
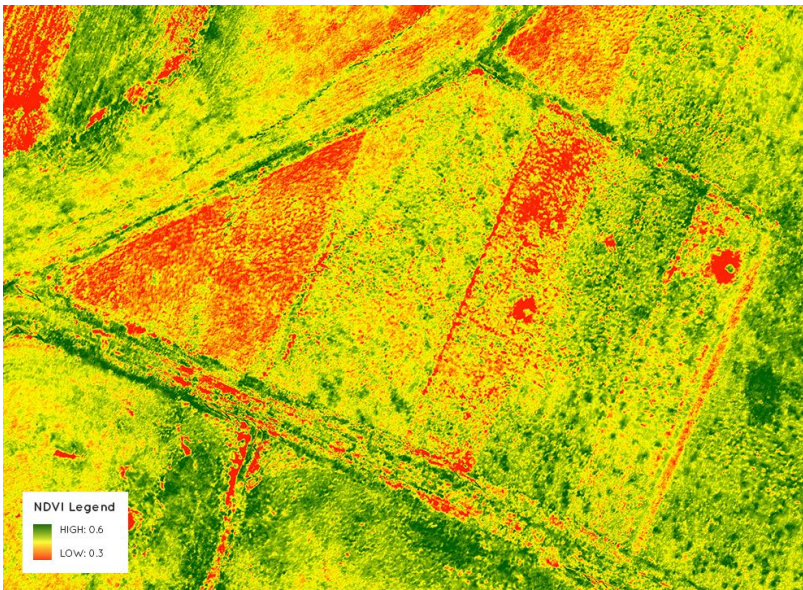


Agriculture

- 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 objects. 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



Motion Pictures



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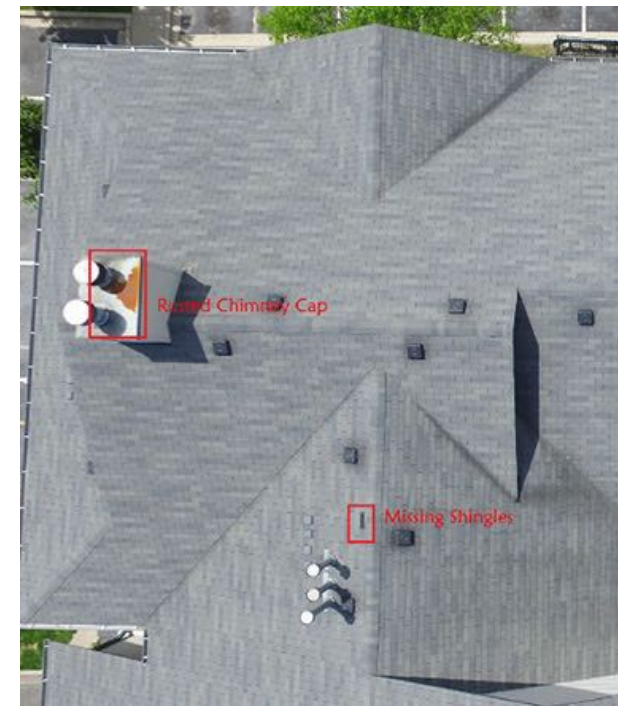
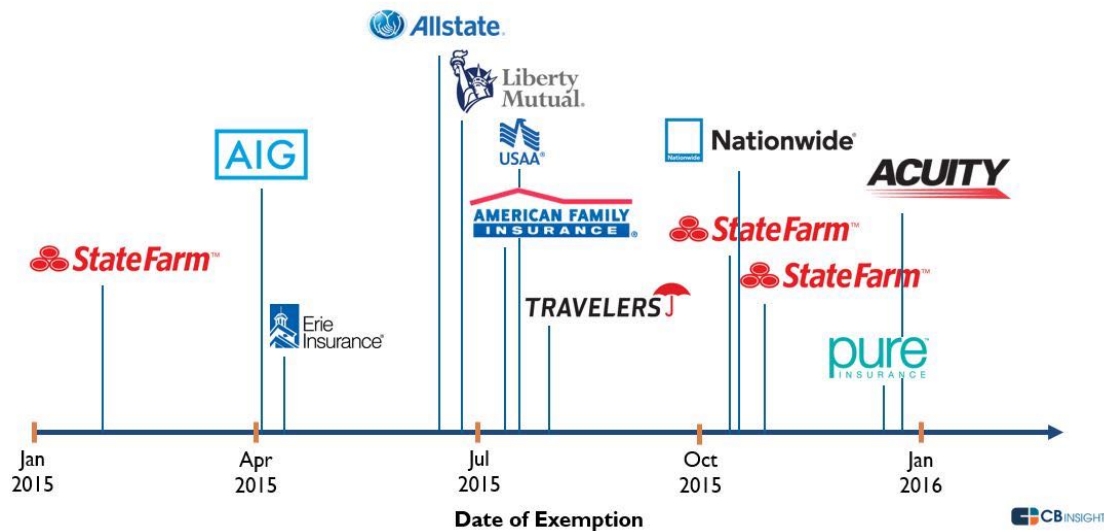




Insurance

- 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

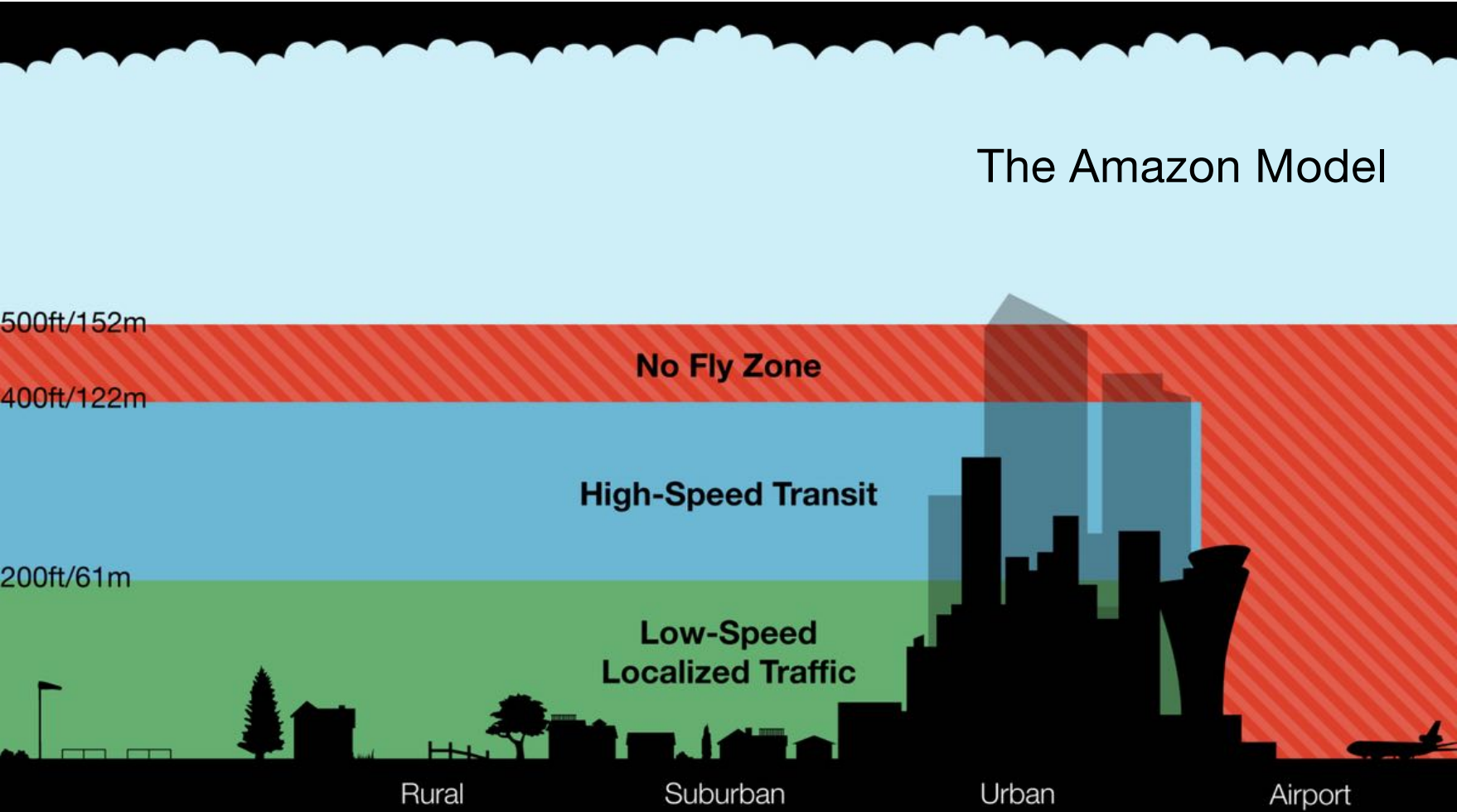
12 exemptions granted over the past year



Optimistic vision for the future...



Filling the Skies with UAVs



Drones Accidents: What can go wrong



© U.S. Air Force

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Man takes to the skies in world-first pentacontakaitetraopter

The Guardian 4 September 2015



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 doesn't assume responsibility

Enrique
Iglesias
During
Concert



Enrique Iglesias Badly Hurt in Drone Accident During Concert

TMZ 31 May 2015

“recovering after having major reconstructive surgery to his hand as the result of an injury the singer suffered during a concert in Tijuana” BBC 3 Jun 2015

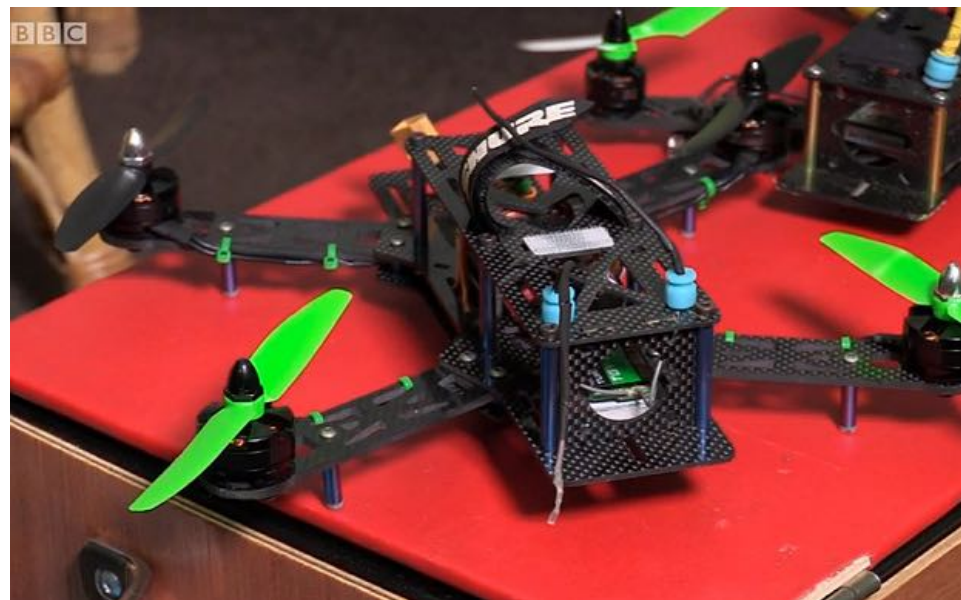


Toddler loses eye after drone propeller sliced through it

Telegraph 29 Nov 2015

[sic]
“An 18-month-old boy lost his left eye when he was hit in the face by an out-of-control drone.

The accident, which happened seven weeks ago, occurred when a drone being flown by family friend ... spiralled out of control.”



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

Fire in Lake Lagunita causes evacuations in Narnia, Enchanted Broccoli Forest

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

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.

Reckless flying



Intrusive Flights



Projections

Fully autonomous flight

By 2020, 4.5 hobbyist drones and 2.5 million commercial drones

Autonomous drone package delivery

First pilotless transport aircraft

