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food & agribusiness industry group

“An Exploration of the Commercial Use of Drones in Agribusiness and in Infrastructure?”

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Drones 101 – Adding Value to Agribusiness and Other Enterprises

Thad Lightfoot, Partner
Dorsey & Whitney LLP
Minneapolis, MN

Chris Draper, PhD, PE, Director
Meidh
Des Moines, IA

National Airspace System (NAS)

- **Any aircraft operations in the national airspace require a certified and registered aircraft, a licensed pilot, and operational approval**

- **NAS Regulated by Classes—Even at Low Altitudes**

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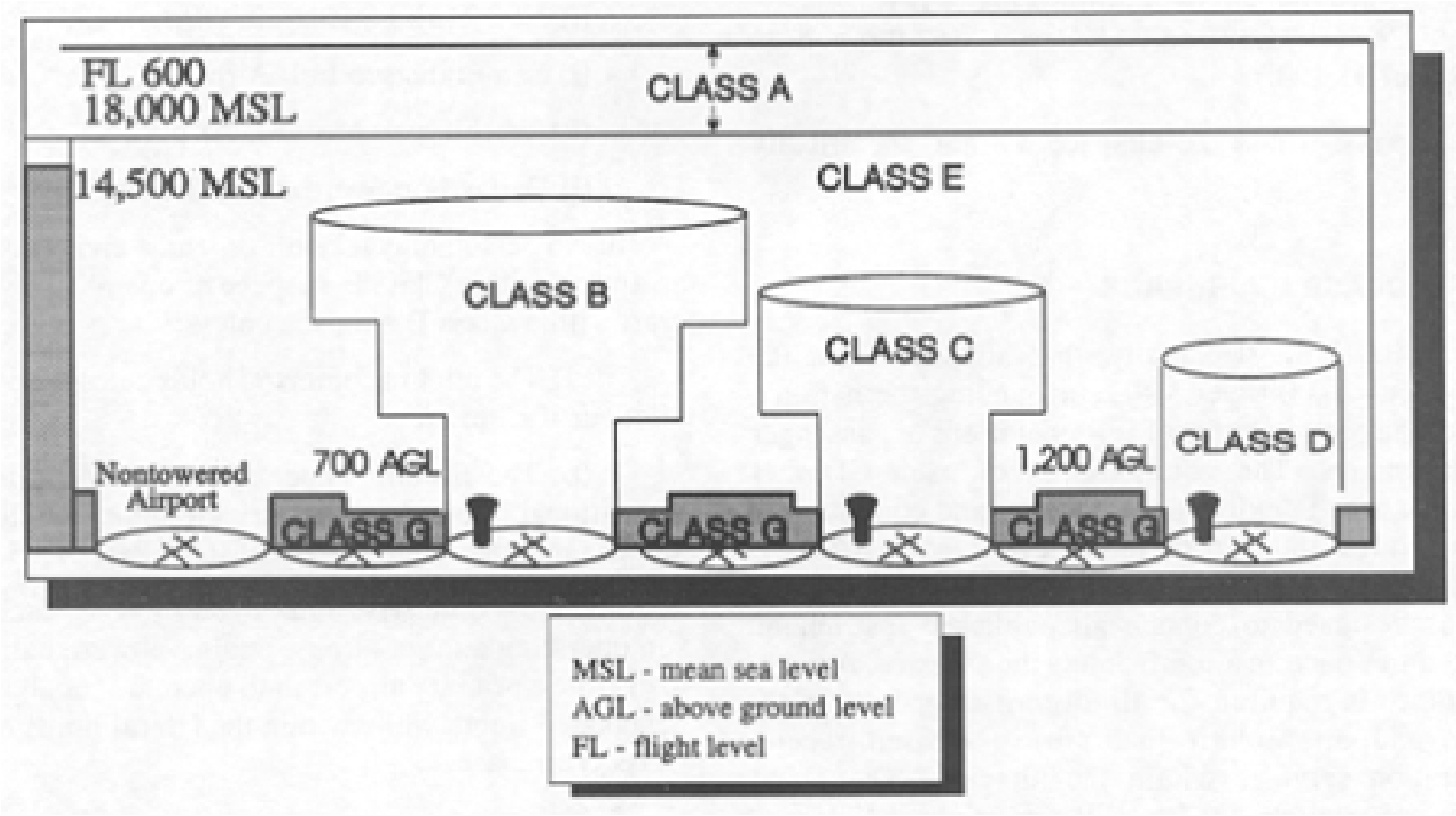
National Airspace System



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Hobby Aircraft

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Section 333 Waiver Process
FAA Modernization & Reform Act

- **Identify a Pilot**
- **Submit an Application**
- **Wait**
- **Apply for a Registration Number**
- **Fly**

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FAA Enforcement—SkyPan International

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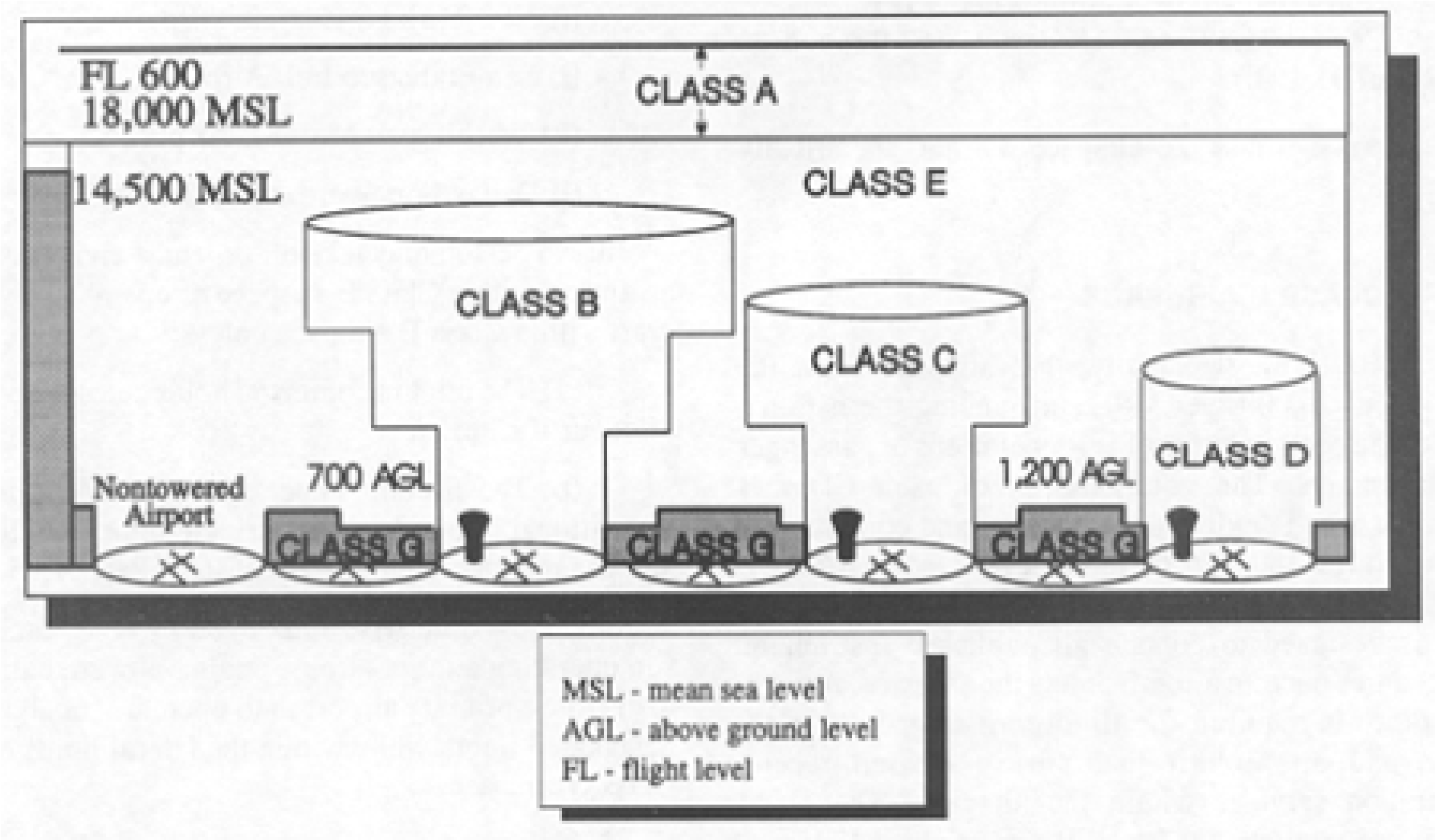
Part 107 Regulations
General Operational Limitations

- **Less Than 55 Pounds**
- **Visual Line of Sight**
- **Daylight Operations**
- **Height 400’ Speed 87 Knots**

Part 107 Regulations
Where Flights Are Allowed



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Part 107 Regulations
Remote Pilot in Command

- **Required Qualifications**
- **Part 61 Pilot Certificate Holders**
- **Foreign Certified UAS Pilots**

Part 107 Regulations
Other Considerations

- **Additional Important Operational Limits**
- **Part 107 Waiver Process**
- **Section 333 Exemption Process**

Part 107 Ag Operations

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Part 107 Infrastructure Operations

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Part 107 Infrastructure Operations

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State Law and Preemption

- **Federal Preemption**
  - **Restrictions on Operations, Equipment or Training**
  - **Local Land Use**
- **Minnesota Law**
- **Iowa Law**

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New York CLE Code

We have some NY lawyers participating remotely today. In accordance with NY CLE Rules, the New York Verification Code for this program is _____.

A window to our regulatory future

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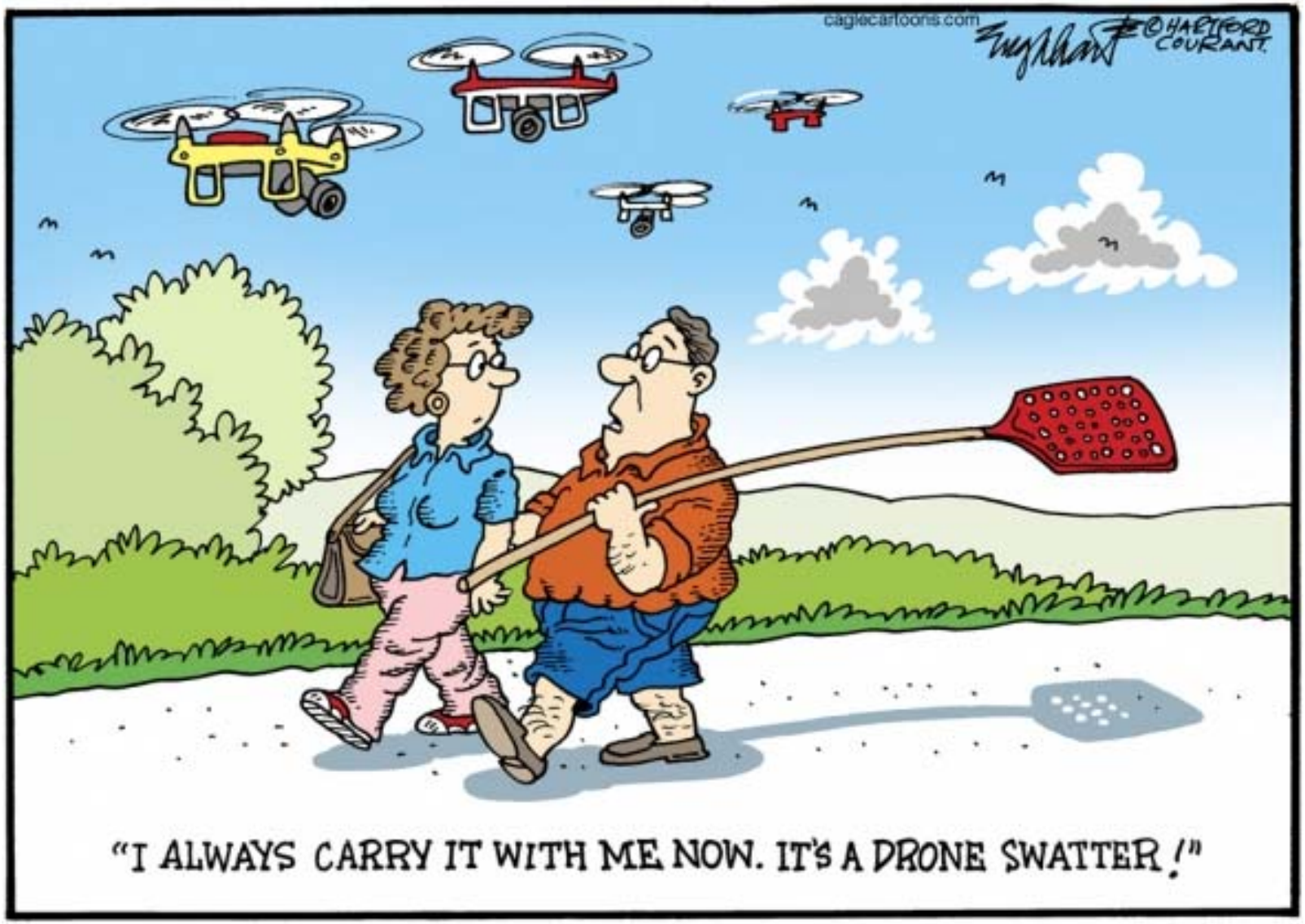

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What is a drone?

Transportation Method

Transportation Method

(Nothing magical)

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Innovation
AND
Safety

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Parrot AR
facebook
Blade
amazon
SPY
Google
POLICE
DRONE SPOTTER
Hob Nobs
Kipper Williams

Drone Diversity

The big aerospace companies that have long led the drone industry offer high-powered, high-priced devices, while a bevy of drone upstarts are pitching lightweight, low-cost drones.

PRICE: **$93 MILLION** | **$100,000** | **$10,000-$15,000** | **$1,300**

BIG AEROSPACE COMPANIES — DRONES OF SMALLER STARTUPS

	Global Hawk	ScanEagle	Lancaster Hawkeye	Phantom Vision 2+
NAME / Manufacturer	Northrop Grumman	Insitu*	PrecisionHawk	DJI
PRIMARY USE	Military intelligence	Surveillance	Agriculture	Photography
SIZE	47.6 feet long by 130.9-foot wingspan	5.6 x 10.2 ft. wingspan	4 x 4 ft. wingspan	0.95 x 0.95 ft. quadcopter
WEIGHT	32,250 lb.	48.5 lb.	3 lb.	2.8 lb.
ENDURANCE	28 hours	24 hours	45 min	25 min
SPEED	357 mph	57 to 69 mph	25 mph	25 mph
OPERATING ALTITUDE	60,000 ft.	19,500 ft.	400 ft.	Less than 400 ft.

Source and photos: the companies *Boeing subsidiary

The Wall Street Journal

11

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BIG AEROSPACE COMPANIES

DRONES OF SMALLER STARTUPS

Cas = 10.8 mph

NAME / Manufacturer	Global Hawk Northrop Grumman	ScanEagle Insitu*	Lancaster Hawkeye PrecisionHawk	Phantom Vision 2+ DJI
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PRICE: **$93 MILLION** **$100,000**

BIG AEROSPACE COMPANIES

DRONES OF SMALLER STARTUPS

Cas = 10.8 mph

Vt = 35.4 mph

NAME Manufacturer	**Global Hawk** Northrop Grumman	**ScanEagle** Insitu*	**Lar** Prec	
PRIMARY USE	Military intelligence	Surveillance	Agriculture	Photography
SIZE	47.6 feet long by 130.9-foot wingspan	5.6 x 10.2 ft. wingspan	4 x 4 ft. wingspan	0.95 x 0.95 ft. quadcopter
WEIGHT	32,250 lb.	48.5 lb.	3 lb.	2.8 lb.
ENDURANCE	28 hours	24 hours	45 min	25 min
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The Wall Street Journal

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NAME / Manufacturer	Global Hawk Northrop Grumman	ScanEagle Insitu*	Lancaster Hawkeye PrecisionHawk	Phantom Vision 2+ DJI
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BIG AEROSPACE COMPANIES | DRONES OF SMALLER STARTUPS

Cas = 2.6 mph

	Manufac		**Lancaster Hawkeye** PrecisionHawk	**Phantom Vision 2+** DJI
PRIMARY USE	Military intelligence	Surveillance	Agriculture	Photography
SIZE	47.6 feet long by 130.9-foot wingspan	5.6 x 10.2 ft. wingspan	4 x 4 ft. wingspan	0.95 x 0.95 ft. quadcopter
WEIGHT	32,250 lb.	48.5 lb.	3 lb.	2.8 lb.
ENDURANCE	28 hours	24 hours	45 min	25 min
SPEED	357 mph	57 to 69 mph	25 mph	25 mph
OPERATING ALTITUDE	60,000 ft.	19,500 ft.	400 ft.	Less than 400 ft.

Source and photos: the companies *Boeing subsidiary

The Wall Street Journal

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BIG AEROSPACE COMPANIES — DRONES OF SMALLER STARTUPS

Cas = 2.6 mph

Vt = 20.9 mph

			Lancaster Hawkeye PrecisionHawk	Phantom Vision 2+ DJI
PRIMARY USE	Military intelligence	Surveillance	Agriculture	Photography
SIZE	[illegible] feet long	56 x 10.2 ft. wingspan	4 x 4 ft. wingspan	0.95 x 0.95 ft. quadcopter
WEIGHT	32,250 lb.	48.5 lb.	3 lb.	2.8 lb.
ENDURANCE	28 hours	24 hours	45 min	25 min
SPEED	357 mph	57 to 69 mph	25 mph	25 mph
OPERATING ALTITUDE	60,000 ft.	19,500 ft.	400 ft.	Less than 400 ft.

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Prevent

(Certification)

vs

Protect

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The **NEW** Small UAS Rule (Part 107), including all pilot and operating rules, is in effect as of 12:01 a.m. EDT on **August 29, 2016**.

For more information, please review the following materials:

- Latest UAS News
- Summary of the Small UAS Rule (PDF)
- Small UAS Advisory Circular – How to Use the Rule (PDF)
- Complete Text of the Small UAS Rule
- Part 107 Knowledge Test Prep
- How to fly a UAS for your work or business

The FAA's New Drone Rules Are Effective Today

Here's important information you should know about the FAA's new Part 107 small drone rule.

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Provision	Canada	Small UAS NPRM	Micro UAS Sub-classification
Definition of Small UAS	Up to 4.4 lbs (2 kg)	Up to 55 lbs (24 kg)	Up to 4.4 lbs (2 kg).
Maximum Altitude Above Ground	300 feet	500 feet	400 feet.
Airspace Limitations	Only within Class G airspace	Allowed within Class E in areas not designated for an airport. Otherwise, need ATC permission. Allowed within Class B, C and D with ATC permission. Allowed in Class G with no ATC permission	Only within Class G airspace.
Distance from people and structures	100 feet laterally from any building, structure, vehicle, vessel or animal not associated with the operation and 100 feet from any person	Simply prohibits UAS operations over any person not involved in the operations (unless under a covered structure)	Flying over any person is permitted.
Ability to extend operational area	No	Yes, from a waterborne vehicle	No.
Autonomous operations	No	Yes	No.
Aeronautical knowledge required	Yes; ground school	Yes; applicant would take knowledge test	Yes; applicant would self-certify.
First person view permitted	No	Yes, provided operator is visually capable of seeing the small UAS	No.
Operator training required	Yes, ground school	No	No.
Visual observer training required	Yes	No	No.
Operator certificate required	No	Yes (must pass basic UAS aeronautical test)	Yes (no knowledge test required).
Preflight safety assessment	Yes	Yes	Yes.
Operate within 5 miles of an airport	No	Yes	No.
Operate in a congested area	No	Yes	Yes.
Liability insurance	Yes, $100,000 CAN	No	No.
Daylight operations only	Yes	Yes	Yes.
Aircraft must be made out of frangible materials	No	No	Yes.

Line of site

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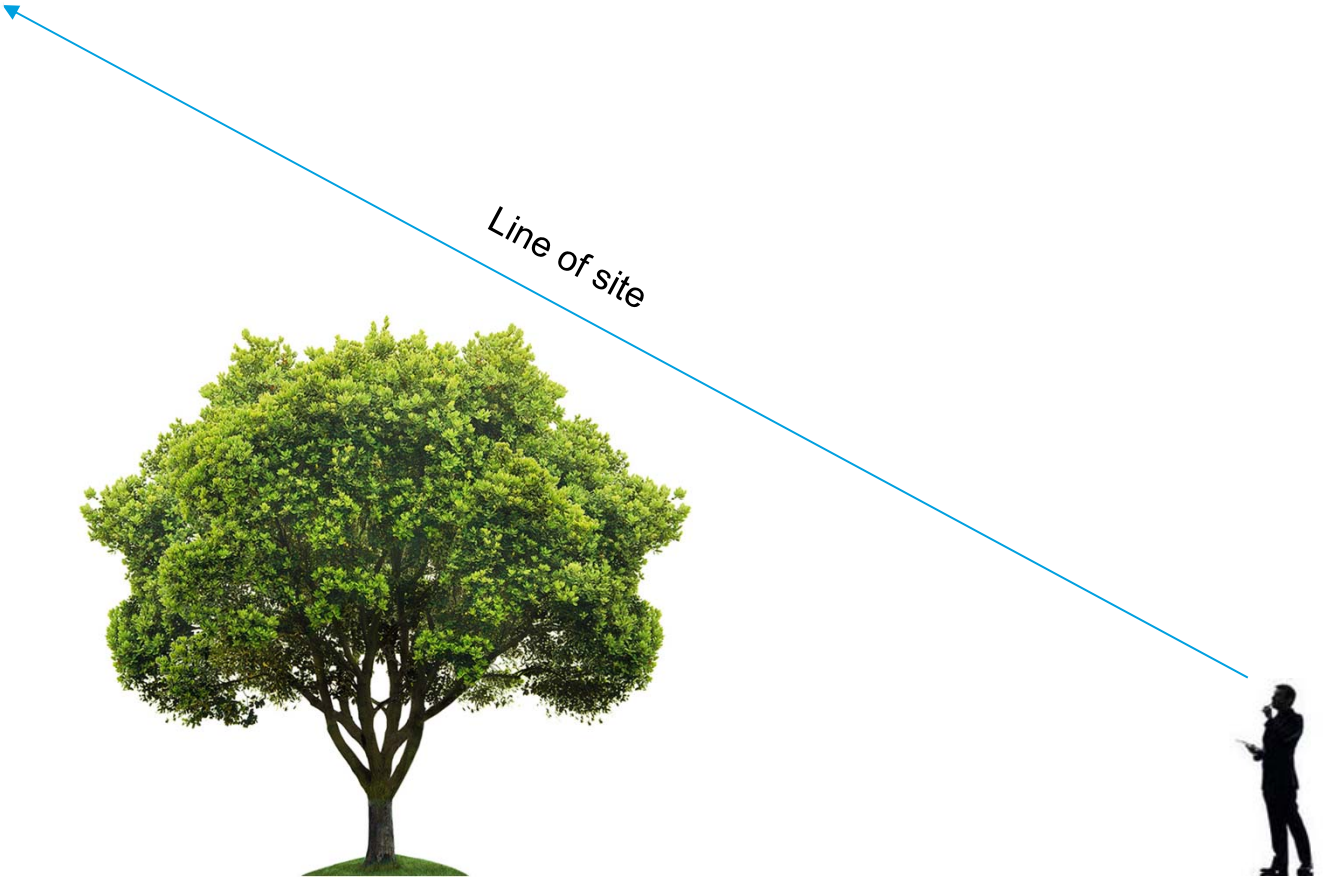
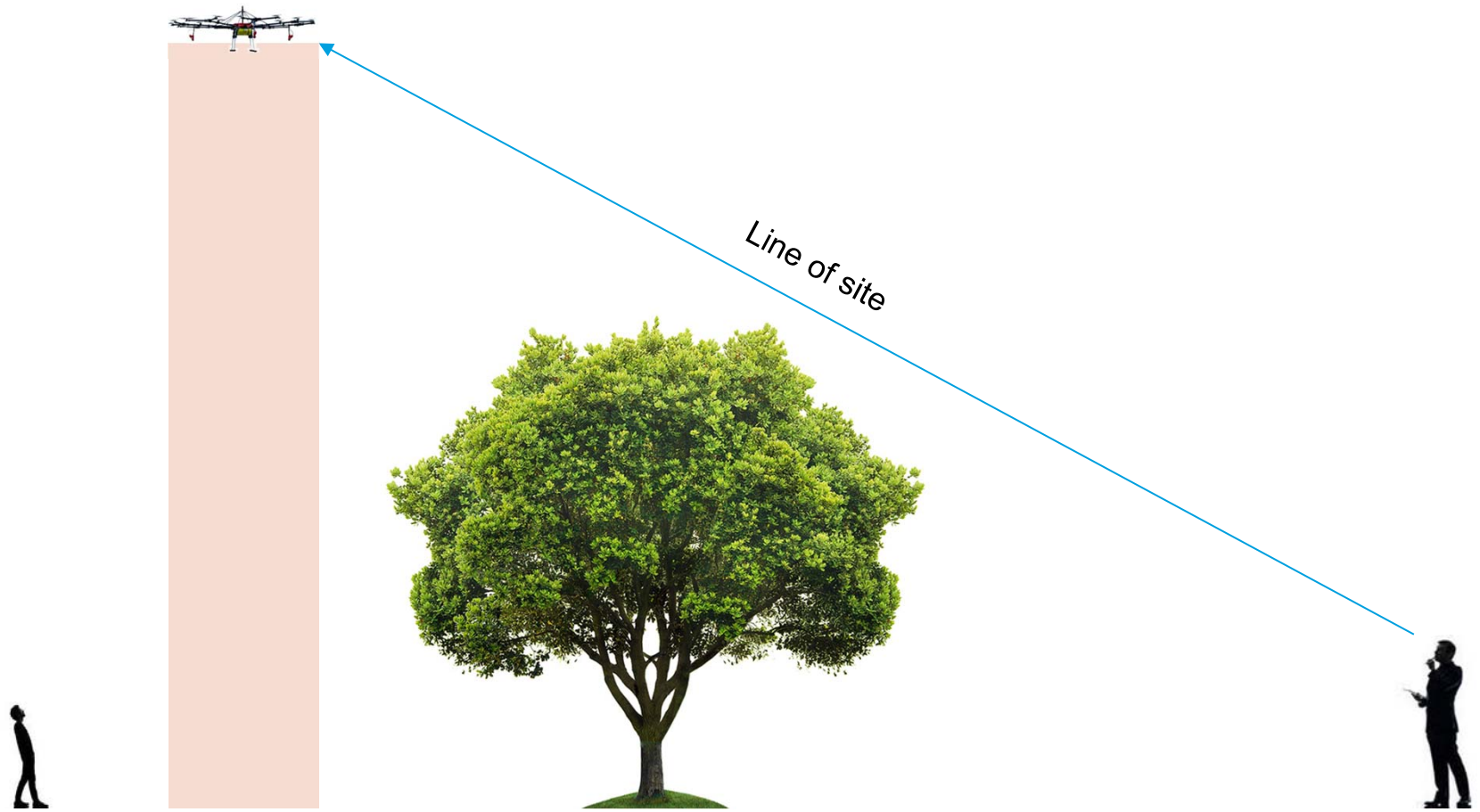

Line of site



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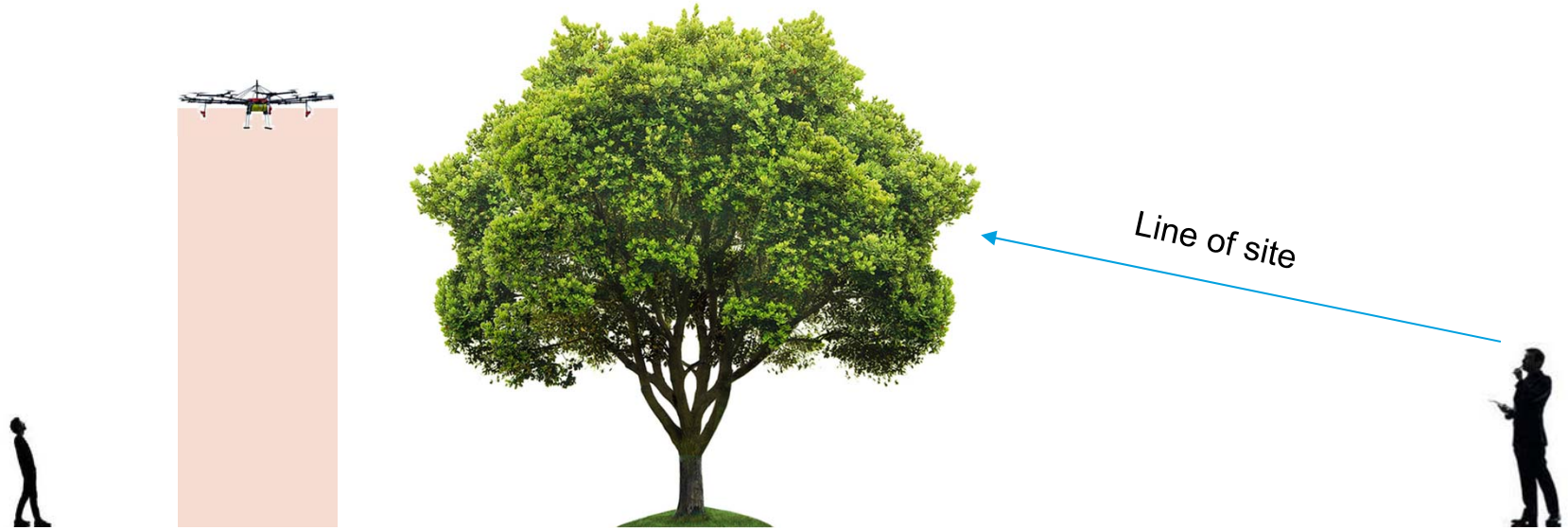

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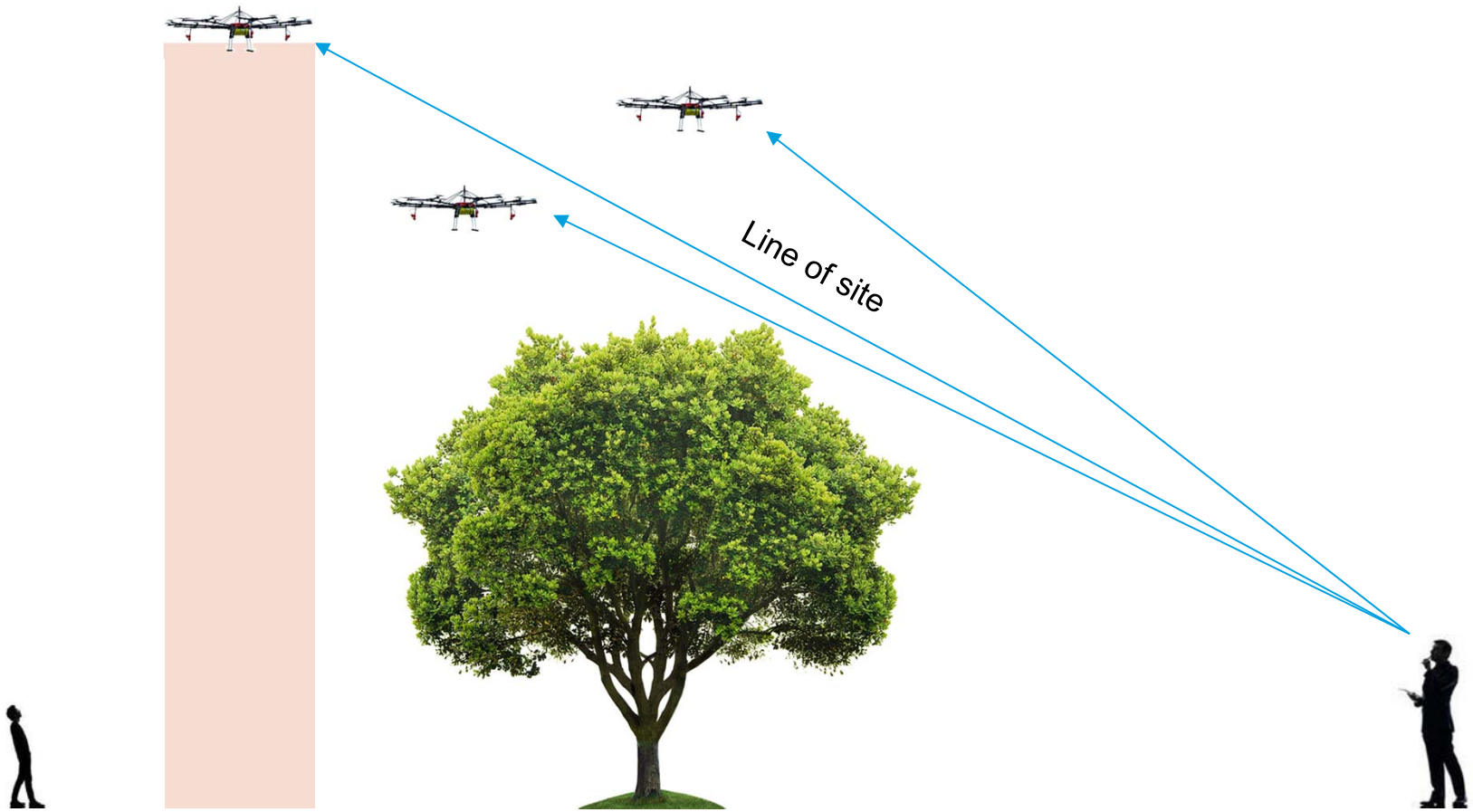

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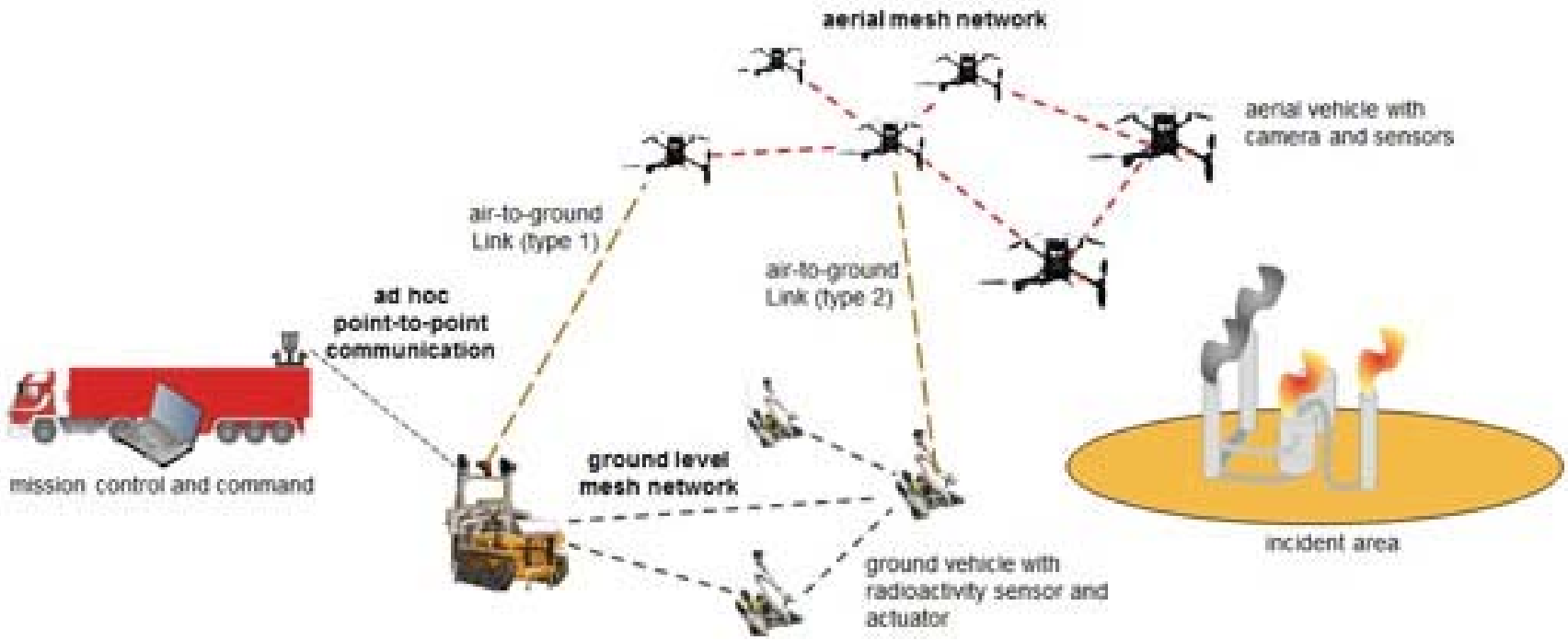
aerial mesh network
aerial vehicle with
camera and sensors
air-to-ground
Link (type 1)
air-to-ground
Link (type 2)
ad hoc
point-to-point
communication
mission control and command
ground level
mesh network
ground vehicle with
radioactivity sensor and
actuator
incident area

20 minutes

(flight time)

+

2 hours

(stitching)

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What does that cost?

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Waivers to Certain Small UAS Operating Rules

The small UAS rule (14 CFR part 107) includes the option to apply for a certificate of waiver, which allows for a small UAS operation to deviate from certain operating rules if the FAA finds that the proposed operation can be performed safely.

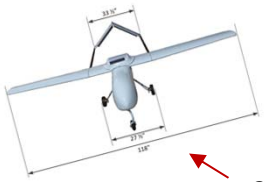
- Waivable sections of part 107
- Operation from a moving vehicle or aircraft (§ 107.25)*
- Daylight operation (§ 107.29)
- Visual line of sight aircraft operation (§ 107.31)*
- Visual observer (§ 107.33)
- Operation of multiple small unmanned aircraft systems (§ 107.35)
- Yielding the right of way (§ 107.37(a))
- Operation over people (§ 107.39)
- Operation in certain airspace (§ 107.41)
- Operating limitations for small unmanned aircraft (§ 107.51)

*No waiver of this provision will be issued to allow the carriage of property of another by aircraft for compensation or hire.

Where are we Going?

Energy

Our Approach: Characterize The Vehicle



d_{max}

1 Find a Tier 1 area to define the impact footprint and Tier 2 effective area

$A_{max} = ¼\pi (d_{max})^2$

$A_{eff} = k_A A_{max}$

NOTE: FAA AST has used a kA equal to 2 for high energy impacts – it is expected that this value would be found through Tier 1 evaluation or simple manufacturer testing

2 Find a Tier 1 impact energy and Tier 2 effective energy

$E_{max} = 0.5\ m\ (v_{term})^2$

$E_{eff} = k_D E_{max}$

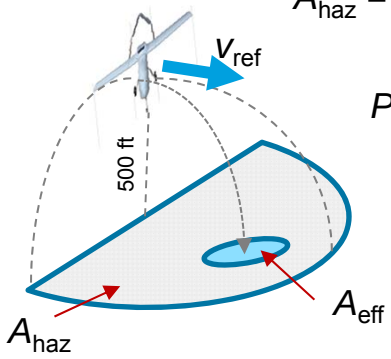
$v_{term} = 30\ sqrt(\beta)$

NOTE: The compact fragment approximation accounts for blunt impact of the entire vehicle – exposed rotors or propellers that are operating at impact cannot be ignored as an additional and unique source of casualty

3 Find the probability of impacting at any specific location in the Tier 1 hazard area

$A_{haz} = 0.5 * \pi\ (v_{ref} * (500 / v_{term}))^2$

$Pr_{imp|fail} = A_{eff} / A_{haz}$



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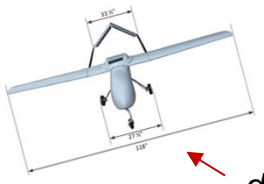
Our Approach: Compute Threshold



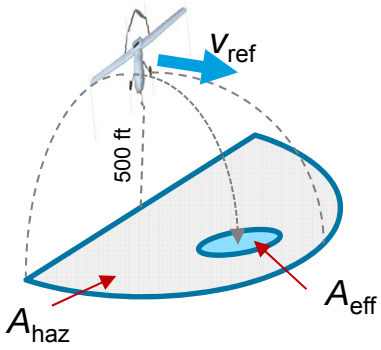
4 Define critical values for failures associated with this vehicle:

$A_{max} = ¼\pi (d_{max})^2 = 76$ sft

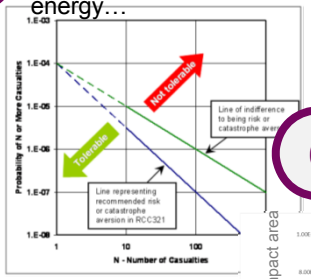
$A_{eff} = k_A A_{max}$
$= 0.5 * 76$
$=$ **38 sft**

$A_{haz} = 0.5 * \pi (v_{ref} * (500 / v_{term}))^2$
$= 0.5 * \pi (78 * (500 / 90))^2$
$=$ **294,960 sft**

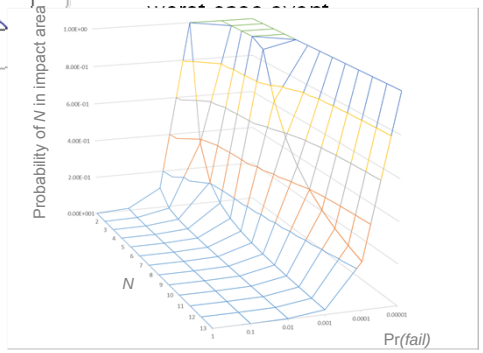
$Pr_{imp|fail} = A_{eff} / A_{haz}$
$= 38 / 294{,}960$
$=$ **1.29e-4**



5 Using the catastrophe risk profile recommended by the Range Commanders Council as a function of effective impact energy…



6 …calculate the hyperlocal population density that must be avoided by the



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Improvement: Overflight

Removes ambiguity: if a vehicle failure has the ability to reach a population density that busts the risk threshold, it could be considered operating "over" those persons

Casualty potential: this classification can produce casualties with blunt impacts at speeds as low as 10 mph

		permission	
Distance from people and structures	100 feet laterally from any building, structure, vehicle, vessel or animal not associated with the operation and 100 feet from any person.	Simply prohibits UAS operations over any person not involved in the operations (unless under a covered structure)	Flying over any person is permitted
Ability to extend	No	Yes, from a	No

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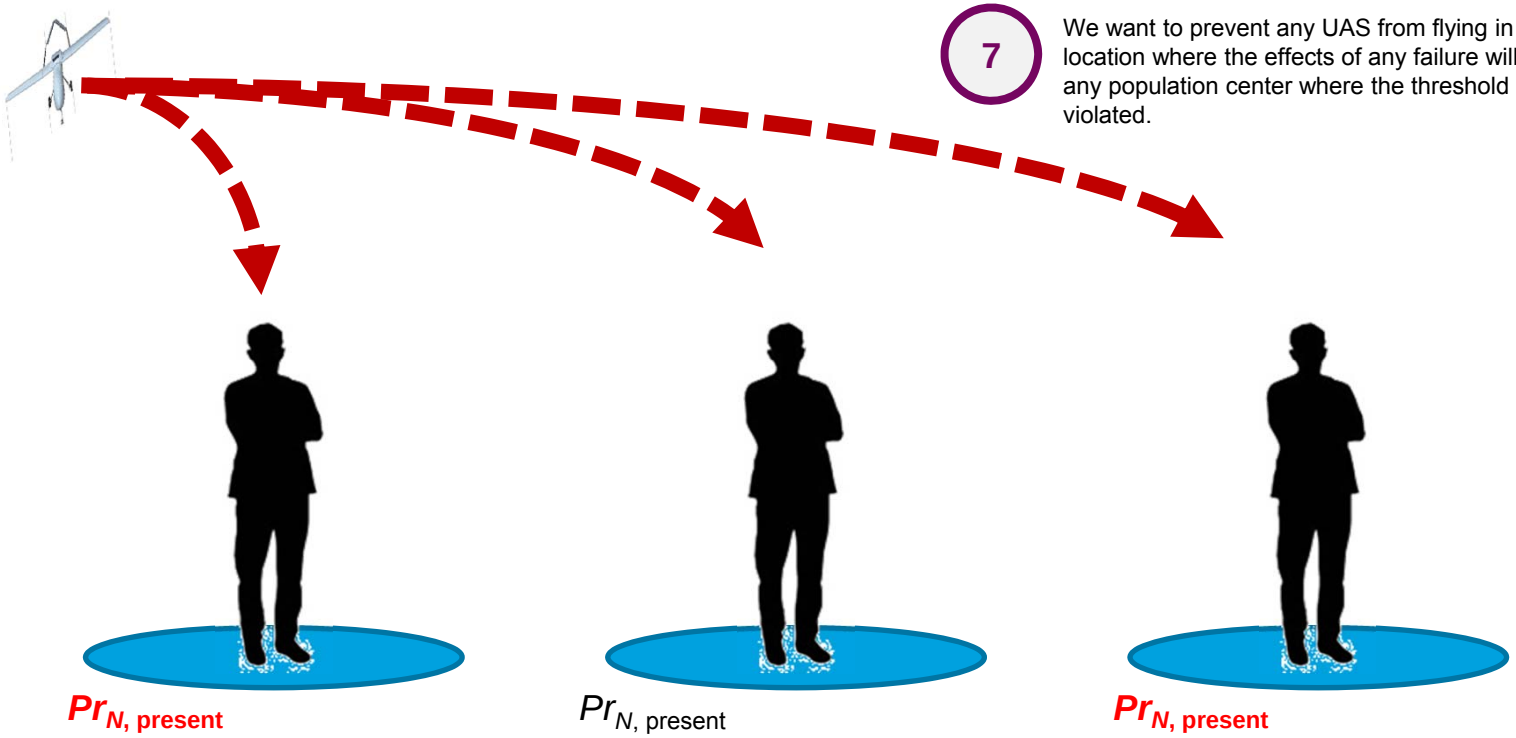
Our Approach: Assess Presence



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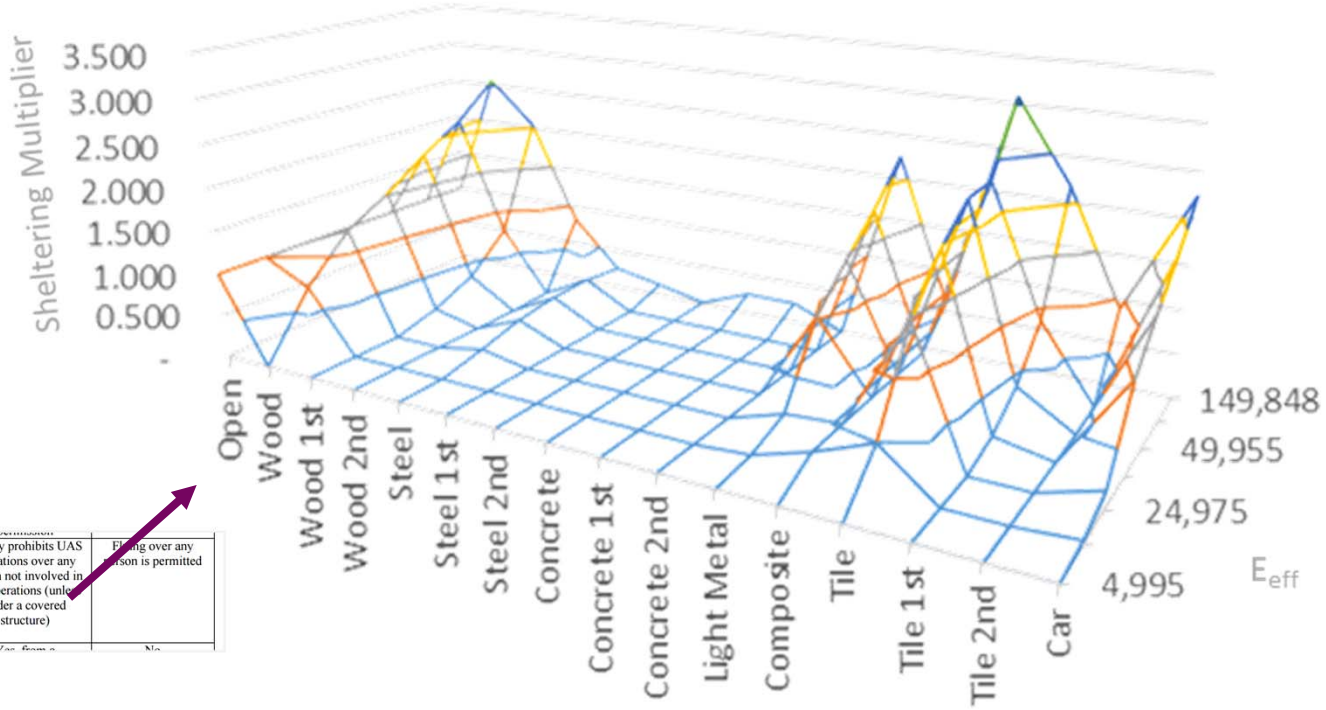
Improvement: Sheltering

Distance from people and structures	100 feet laterally from any building, structure, vehicle, vessel or animal not associated with the operation and 100 feet from any person.	Simply prohibits UAS operations over any person not involved in the operations (unless under a covered structure)	Flying over any person is permitted
Ability to extend	No	Yes, from a	No

Sheltering limitations: not all shelters are equal, and it is vital to understand the level of energy that a particular shelter can withstand in order to ensure it is actually protecting any inhabitants

Improvement: Sheltering Coefficient



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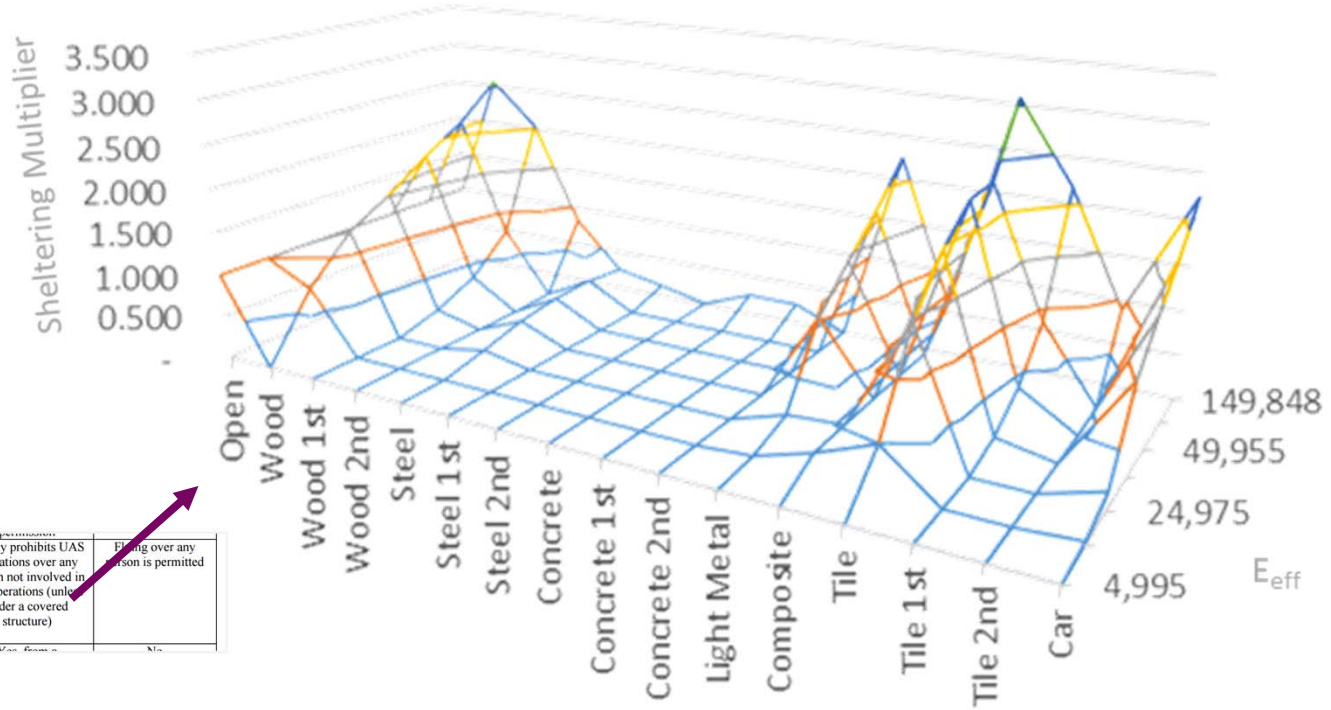
Improvement: Sheltering Coefficient



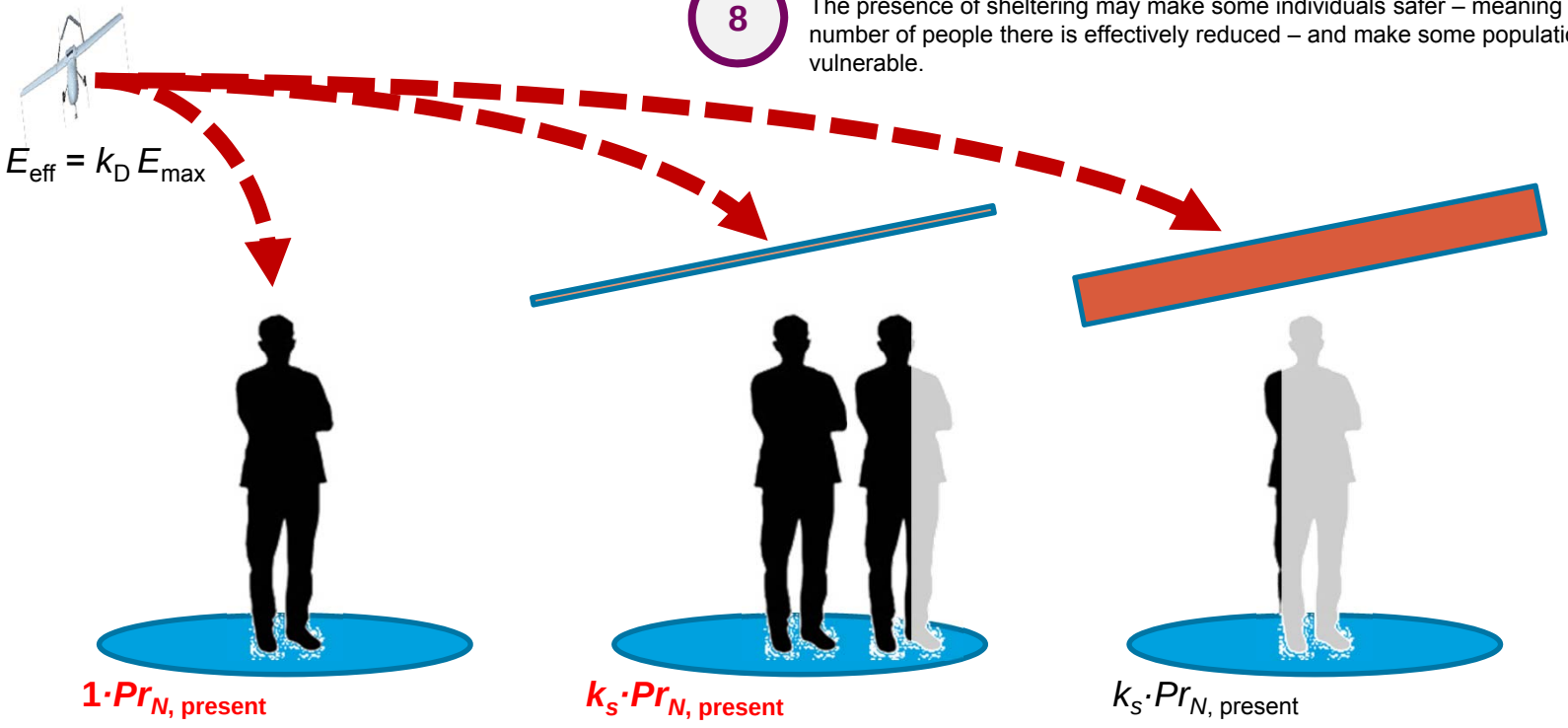
Distance from people and structures	100 feet laterally from any building, structure, vehicle, vessel or animal not associated with the operation and 100 feet from any person.	Simply prohibits UAS operations over any person not involved in the operations (unless under a covered structure)	Flying over any person is permitted

Summer 2017

Our Approach: Assess Vulnerability

8

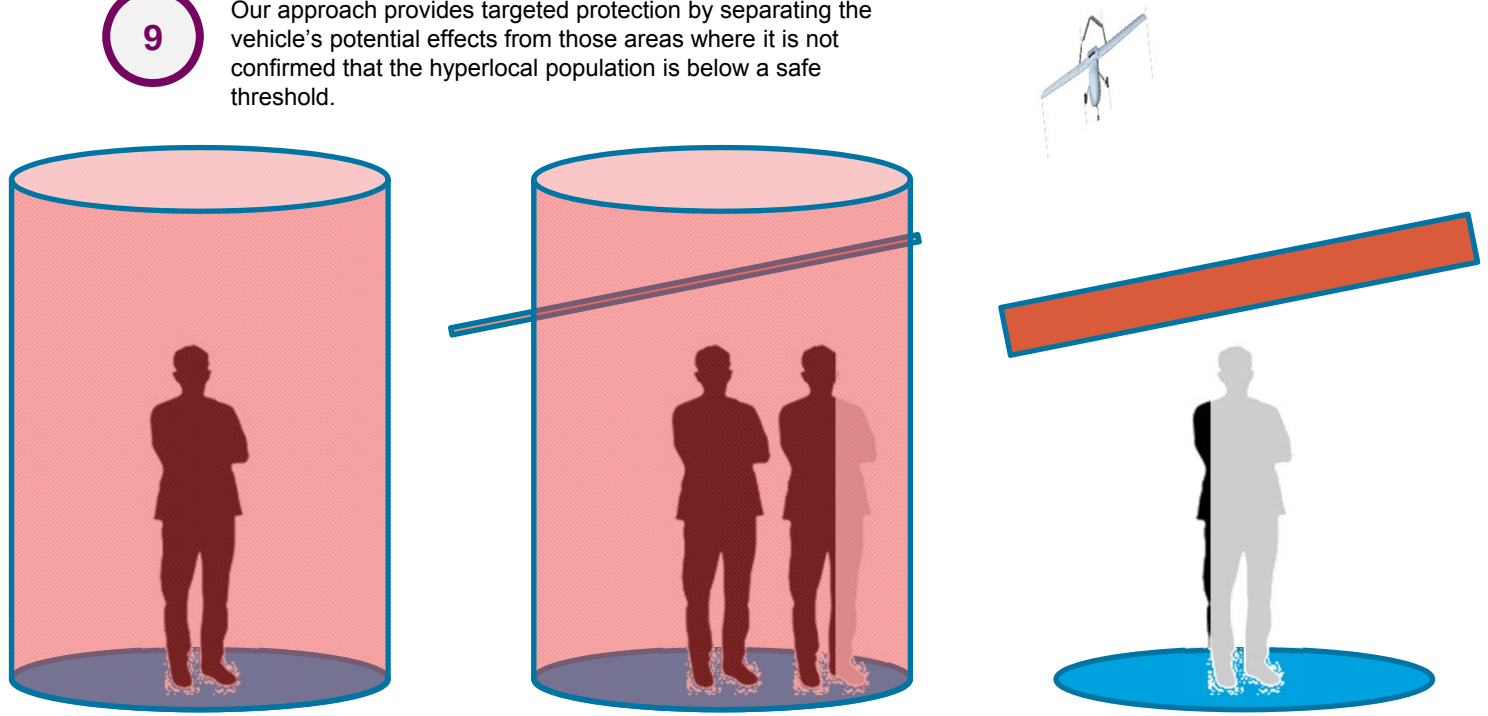
The presence of sheltering may make some individuals safer – meaning the number of people there is effectively reduced – and make some populations more vulnerable.



Our Approach: Targeted Protection

9

Our approach provides targeted protection by separating the vehicle's potential effects from those areas where it is not confirmed that the hyperlocal population is below a safe threshold.



$1 \cdot Pr_{N,\ present}$

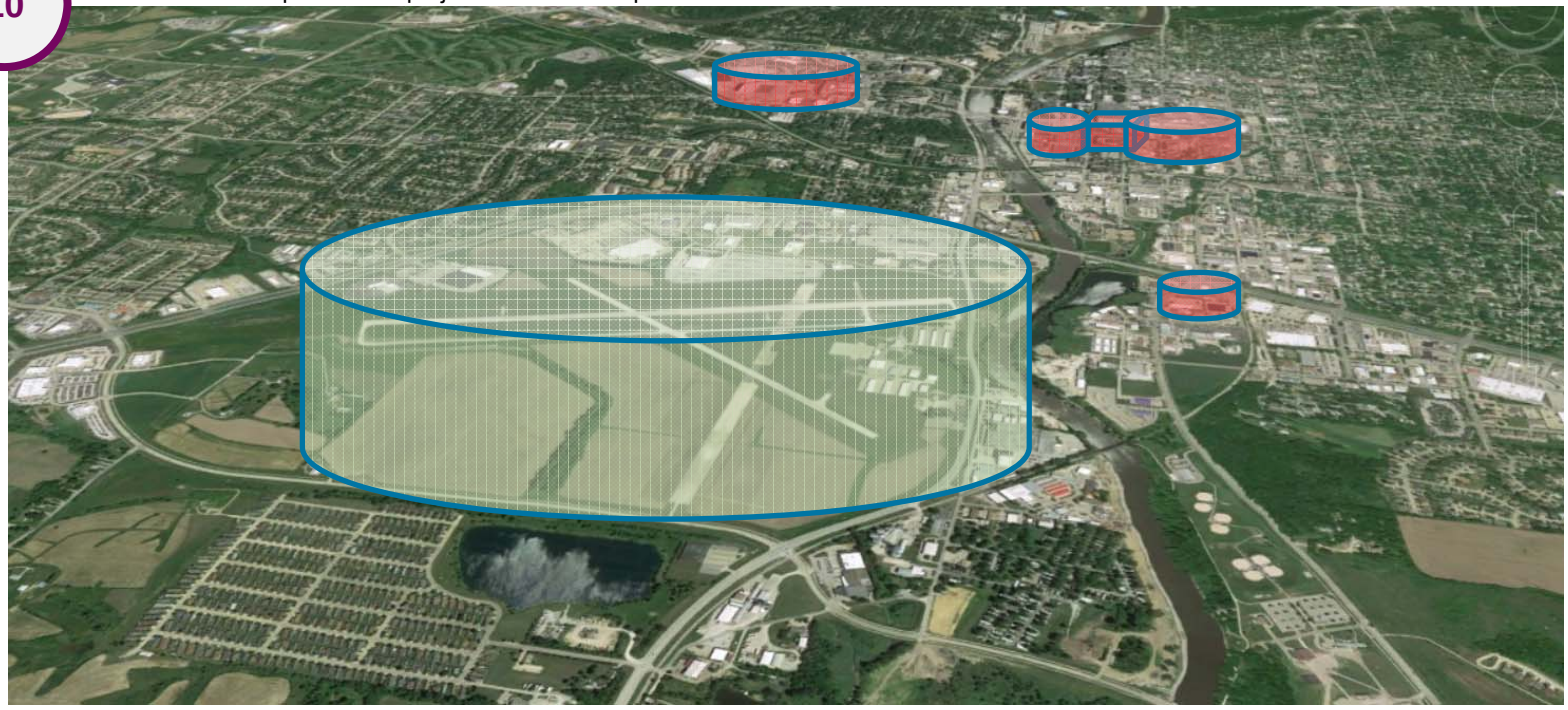
$k_s \cdot Pr_{N,\ present}$

$k_s \cdot Pr_{N,\ present}$

Our Result: Define D-S Projection

10

The result is a Draper-Santos projection where all operations of that vehicle are “safe” outside of those restricted areas.



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Scalable Strategy

Scalable Solution: defining classes of UAS based on demonstrated reliability and effective transferable energy can produce static operational volumes within which any operation would be considered safe.

How: issue drone-specific aeronautical charts.

NOTE: The TBM-3M analysis does not have significant flight history, so is computing its probability of failure estimate based on the guidance contained in the FAA Flight Safety Analysis Handbook, Version 1.0

NOTE: The TBM-3M analysis is examining the effective transferable energy in the context of the associated failure – so if the failure mode would result in an intact impact, that energy is used; if it would result in a parachute deployment, the impact under canopy is used

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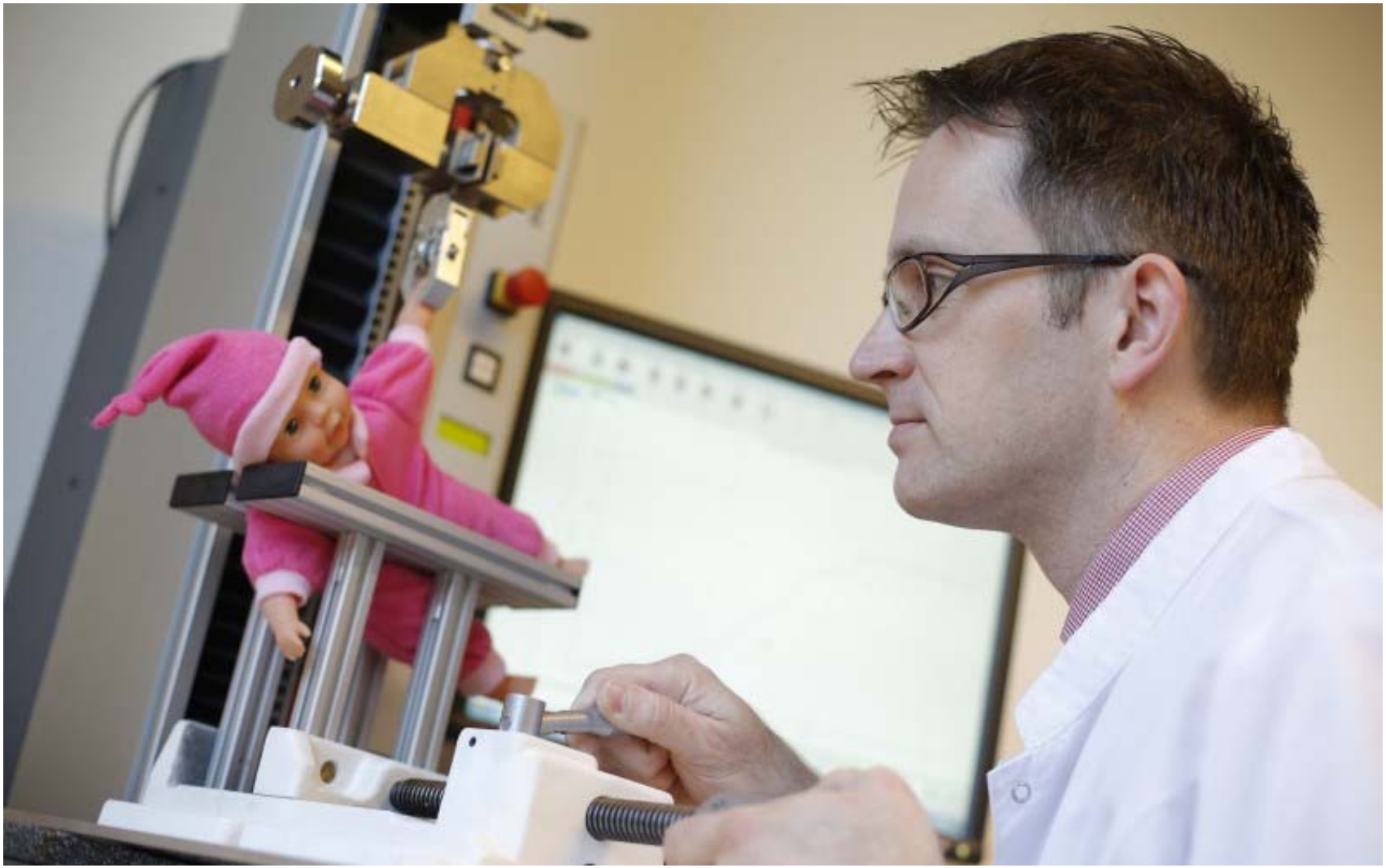
Design Solutions



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Under 11 ft-lbs

=

Safe

How much can we ask the FAA to do?

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Reality

=

Tradeoffs

What do you want?

Questions?

- **Contact**

  Chris Draper, Ph.D., P.E.
  515 210-0214
  chris.draper@meidh.com

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This program will resume at 10:00 a.m. CT

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Privacy and Intellectual Property Issues in Precision Agriculture and Infrastructure

Jamie Nafziger

August 31, 2016

What is Precision Agriculture?

- **Use of technology to collect and process real-time, site-specific data and inform farming decisions**
- **Connecting weather predictions to irrigation systems**
- **Seed choices**
- **Pesticides and fertilizer application**

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Components of Precision Agriculture Ecosystem

- **Hardware**
  - **Drones (UAS)**
  - **Sensors and cameras**
  - **Smart farm equipment**
  - **Communications systems**
  - **Mobile Devices**
  - **Satellites**
- **Software**
  - **Apps**
  - **Cloud-based software**

Components of Precision Agriculture Ecosystem (cont'd)

- **Talent**
  - **Producers**
  - **Drone operators**
  - **Crop specialists**
  - **Applicators**
- **Data**
  - **Geolocation**
  - **Weather**
  - **Soil condition**
  - **Historical results**
  - **Many other variables**

Importance for Business

- **Increased yields**
- **Reduced environmental impact**
- **Cost savings**
- **International opportunities**

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Using Drones For Infrastructure

- **Maintenance inspections (distribution lines, wind turbines, solar)**
- **Storm damage assessments**
- **Surveying construction**
- **Security**

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Key Legal Issues

- **Intellectual Property**
- **Privacy**
- **Licensing**
- **Regulations**
- **State and Federal Drone-Specific Laws**

Fundamental: Is Sharing Farm Data Freely a Problem or an Opportunity?

- **May only get best value of data if individual farm data aggregated into larger dataset**
  - **Research benefits**
  - **Benchmarking**
- **Difficulty and cost of negotiating licenses individually between each grower and each vendor**

Intellectual Property: Legal Standards

- **Is data collected from farms protectable intellectual property?**
- **Trade secret protection**
- **Uniform Trade Secrets Act (UTSA) defines trade secret as:**
  - **information, including a formula, pattern, compilation, program, device, method, technique, or process;**
  - **that derives independent economic value, actual or potential, from not being generally known to or readily ascertainable through appropriate means by other persons who might obtain economic value from its disclosure or use; and**
  - **is the subject of efforts that are reasonable under the circumstances to maintain its secrecy**
- **Some farm data may qualify; info collected by drones may not**

Other Relevant Legal Standards

- **Real Property**
  - **How far up does ownership extend if you own the land?**
    - **FAA claims right to regulate National Airspace System (NAS) from ground to near space**
    - **Some courts have used arbitrary 500 foot mark**
    - ***Causby* 328 U.S. 256 (1946): land owner owns at least as much space above the ground as he can occupy or use**
    - **Even if you own space, do you have rights in data collected from it?**

Trespass/Nuisance

- **Trespass**
  - **Knowingly entering another person's property without permission**
  - **Damages – not ownership**
- **Nuisance**
  - **Use and enjoyment of land is interfered with substantially and unreasonably through thing or activity**
  - **Damages – not ownership**
- **Looking on from adjacent parcel**
- **Practical reality: UAS can fly at heights where difficult to detect**

Intellectual Property: Practical Solutions

- **Licensing**
  - **Different categories of data?**
    - **Agreements between growers, software and hardware vendors, service providers, agronomists**
    - **Agreements between software and hardware providers**
  - **Who can use data?**
  - **What can they do with it?**
- **Ag Data Transparency Evaluator (American Farm Bureau Federation)**
- **Standards/Interoperability**
  - **AgGateway – Standardized Precision Ag Data Exchange (SPADE) and Precision Ag Irrigation Leadership (PAIL)**
  - **Open Ag Data Alliance (OADA)**
  - **Large technology providers: Deere acquisition of Precision Planting (connecting Deere hardware to Climate Corp. software system), Monsanto building open platform**
- **Data repositories**

New York CLE Code

We have some NY lawyers participating remotely today. In accordance with NY CLE Rules, the New York Verification Code for this program is _____.

Privacy: Legal Standards

- **Legal and regulatory framework**
- **Barriers to understanding and compliance**
- **Due diligence required to get information needed for assurances requested by growers, privacy policies, and legal compliance**

Legal Framework: Privacy Overview

- **No federal comprehensive privacy law (instead specific areas: financial, health, etc.)**
- **State laws**
  - **Violations of reasonable expectation of privacy**
- **Federal Trade Commission**
  - **Deceptive or unfair acts**
  - **Individual person and his or her device**
  - **Collecting, using and sharing of personal information**
  - **Privacy policies – notice & consent**

Drone Privacy Law – Not Passed by House

- **Passed by Senate in April 2016 as part of FAA Reauthorization Act**
- **Final bill passed in July 2016 did not contain these provisions**
  - **Commercial drone operators must disclose if collecting personal information about individual, including using facial recognition**
  - **Disclose how using personal information, including use for advertising or marketing**
  - **Disclose when personal information would be destroyed**
- **Final bill did contain**
  - **FAA shall convene industry to develop standards for remotely identifying operators and owners of UAS**

Fourth Amendment Analogy: Search & Seizure

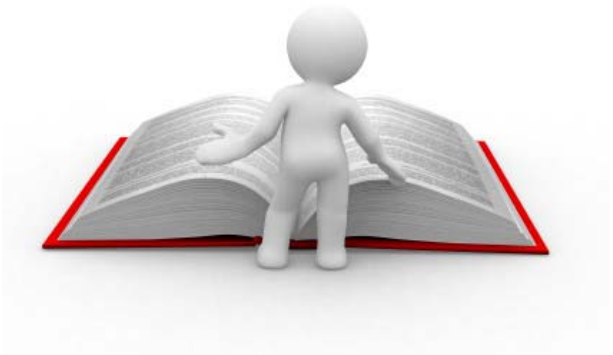
- ***Dow Chemical v. U.S.*** **(1986): aerial photographer hired by EPA photographed facility from 1,200, 3,000 and 12,000 feet – search constitutional – land open to view and observation does not trigger 4th Amendment protection – open area around facility more like an open field than curtilage of home**
- ***California v. Ciraolo*** **(1986): from small plane 1000 feet over fenced-in backyard, police photographed marijuana plants. Supreme Ct. – no reasonable expectation of privacy in things that can be seen from location where public has right to be**

Fourth Amendment Analogy: Search & Seizure

- ***Florida v. Riley*** **(1989): Police observed marijuana plants from helicopter at 400 feet looking through sides & roof of greenhouse left partially open – search constitutional**
- ***Kyllo v. U.S.*** **(2001): thermal imaging from outside home – search unconstitutional – device not in general public use/details of home previously unknowable**

Definitions of “personal information” or “personally identifiable information”

- **Mobile privacy guidelines**
  - **California Attorney General (Jan 2013)**
    - **http://oag.ca.gov/sites/all/files/agweb/pdfs/privacy/privacy_on_the_go.pdf**
  - **FTC (Feb 2013)**
    - **http://www.ftc.gov/sites/default/files/documents/reports/mobile-privacy-disclosures-building-trust-through-transparency-federal-trade-commission-staff-report/130201mobileprivacyreport.pdf**
  - **NTIA (July 2013)**
    - **http://www.ntia.doc.gov/files/ntia/publications/july_25_code_draft.pdf**
  - **Others**
- **FTC consent decrees**



Personal Information/Device Information: Def'n from FTC Settlement - Brightest Flashlight App (December 2013)

- **"Covered Information" shall mean information from or about an individual consumer, including but not limited to (a) a first and last name; (b) a home or other physical address, including street name and name of city or town; (c) an email address or other online contact information, such as an instant messaging user identifier or a screen name; (d) a telephone number; (e) a Social Security number; (f) a driver's license or other state-issued identification number; (g) a financial institution account number; (h) credit or debit card information; (i) a persistent identifier, such as a customer number held in a "cookie," a static Internet Protocol ("IP") address, a mobile device ID, or processor serial number; (j) precise geolocation data of an individual or mobile device, including but not limited to GPS-based, WiFi-based, or cell-based location information; (k) an authentication credential, such as a username and password; or (l) any other communications or content stored on a consumer's mobile device.**

Personal Information/Device Information: Def'n from Updated COPPA Rule (Jan 2013)

- ***Personal information*** **means individually identifiable information about an individual collected online, including: (a) a first and last name; (b) a home or other physical address including street name and name of a city or town; (c) online contact information as defined in this section; (d) a screen or user name where it functions in the same manner as online contact information, as defined in this section; (e) a telephone number; (f) a Social Security number; (g) a persistent identifier that can be used to recognize a user over time and across different websites or online services. Such persistent identifier includes, but is not limited to, a customer number held in a cookie, an Internet Protocol (IP) address, a processor or device serial number, or unique device identifier; (h) a photograph, video, or audio file where such file contains a child's image or voice; (i) geolocation information sufficient to identify street name and name of a city or town; or (j) information concerning the child or the parents of that child that the operator collects online from the child and combines with an identifier described in this definition.**
- ***Online contact information*** **means an email address or any other substantially similar identifier that permits direct contact with a person online, including but not limited to, an instant messaging user identifier, a voice over internet protocol (VOIP) identifier, or a video chat user identifier.**

Personal Information/Device Information: Def'n from FTC Privacy Report (March 2012)

- **Framework applies to all commercial entities that collect or use *consumer data that can be reasonably linked to a specific consumer, computer, or other device*, unless the entity collects only non-sensitive data from fewer than 5,000 consumers per year and does not share the data with third parties. [emphasis added]**
- **"Non-sensitive data" described as "(*e.g.*, data that is not a Social Security number or financial, health, children's, or geolocation information)."**

Personal Information/Device Information: Def'n from California AG Report (Jan 2013)

- **Personally identifiable data are any data linked to a person or persistently linked to a mobile device: data that can identify a person via personal information or a device via a unique identifier. Included are user-entered data, as well as automatically collected data.**
- **Sensitive information is personally identifiable data about which users are likely to be concerned, such as precise geo-location; financial and medical information; passwords; stored information such as contacts, photos, and videos; and children's information.**
- **Types or categories of personally identifiable data include the following: unique device identifier; geo-location (GPS, WiFi, user-entered); mobile phone number; email address; user's name; text messages or email; call logs; contacts/address book; financial and payment information; health and medical information; photos or videos; web browsing history; apps downloaded or used**

Farm Data / Infrastructure Data

- **Examples: elements of farm data that could be considered personal information**
  - **Grower and owner contact information**
  - **Geolocation of person or device**
  - **Image or video of person**
  - **Device identifiers**
  - **Credit card info**
  - **Financial information**

- **Examples: elements of infrastructure data that could be considered personal information**
  - **Geolocation of person or device**
  - **Image or video of person**

Barriers to Understanding and Compliance

- **Privacy policy**
- **Barriers to understanding/ minimizing personal information collection**
  - **Out-of-date/inconsistent definitions of "personal information" make due diligence and compliance with platform policies difficult**
  - **Inadequate disclosures by third parties**
  - **Lack of understanding by developers**
    - **"We use them all."**
    - **Closed source SDKs**

Privacy: Due Diligence on Third Parties

- Software providers/hardware providers
- Database/repository providers
- Analytics providers
- Social media connections
  - Facebook Connect
- App platforms
- Connections between apps
- Cookies and other trackers

Privacy Challenge: Seamless User Interactions in Internet of Things

- **Privacy policy for a piece of drone hardware?**
- **Trees with microchips**
- **Text messages from your corn?**
- **Less interaction with screens and text makes delivering legal notices/making agreements with growers or people on land adjacent to infrastructure inspections more difficult**

Help me Obi Wan Kenobi, you're my only hope; and by the way, if you speak with me, you understand and consent that your personal information, including your photo, name, and exact geolocation may be shared with the Galactic Empire. Nod if you are Obi Wan Kenobi and if you agree.

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In the face of uncertainty…

- **Change law / new law**
- **Self-regulation**
- **Agreements**
  - **Who can access and use data?**
  - **What can they do with it?**
- **Disputes**

Change Law / New Law

- **USTA amendment? Proposed by witness in House Committee on Agriculture hearing October 28, 2015**
  http://agriculture.house.gov/uploadedfiles/10.28.15_ferrell_testimony.pdf
- **Over 45 states have considered or enacted drone legislation**
- **Concepts in Some Proposed/Enacted State Laws**
  - **Identification of drone owner or operator on device**
  - **Registration with state**
  - **Tenants need written permission from landowner to use UAS on property**
  - **Louisiana – farm data collected through UAS belongs to legal owner of property where collected (La. R.S. 3:41-47)**
  - **Texas – misdemeanor to capture, disclose, display, distribute "image" of individual or privately owned real property (narrow exceptions); Ch. 423 of Government Code**
  - **No use over critical infrastructure facilities**

Self-Regulation

- **American Farm Bureau Federation**
  - **Privacy and Security Principles for Farm Data (November 13, 2014; updated May 5, 2015)**
- **Open Ag Data Alliance (OADA)** **http://openag.io/about-us/principals-use-cases/**
- **AgGateway data privacy and use white paper** **http://www.aggateway.org/WorkingGroups/Committees/DataPrivacySecurity.aspx**

NTIA Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

- National Telecommunications and Information Administration
- https://www.ntia.doc.gov/files/ntia/publications/uas_privacy_best_practices_6-21-16.pdf
- Released in May 2016; updated in June when new FAA drone regulation released
- Five voluntary best practices

NTIA Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

1. **Inform others of your use of UAS**
   - **Reasonable effort to provide prior notice to individuals of general timeframe and area where UAS will be intentionally collecting data.**
   - **If UAS operator anticipates collection of covered data, operator should provide privacy policy for data.**
     - **Covered data: "information collected by a UAS that identifies a particular person. If data collected by UAS likely will not be linked to an individual's name or other personally identifiable information, or if the data is altered so that a specific person is not recognizable, it is not covered data."**
     - **Privacy policy should be in place no later than time of collection and made publically available.**
       - **Purpose for which UAS will collect covered data**
       - **Kinds of covered data UAS will collect**
       - **Information regarding any data retention/de-identification practices**
       - **Examples of types of entities with whom covered data will be shared**
       - **How to submit privacy and security complaints/concerns**
       - **Information describing practices in responding to law enforcement requests**

NTIA Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

2. Show care when operating UAS or collecting and storing covered data

- Without compelling need or consent of data subjects, avoid using UAS to intentionally collect covered data where operator knows data subject has reasonable expectation of privacy
- Avoid using UAS for purpose of persistent and continuous collection of covered data about individuals
- Make reasonable efforts to minimize UAS operations over or within private property without consent of property owner or without appropriate legal authority
- Make a reasonable effort to avoid knowingly retaining data longer than reasonably necessary to fulfill specified purposes
- Establish a process to receive privacy or security concerns for covered data

NTIA Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

3. Limit Use and Sharing of Covered Data

- Receive consent if covered data is used for employment eligibility, promotion, or retention; credit eligibility; or health care treatment eligibility
- Avoid using or sharing covered data for purpose not included in privacy policy covering UAS data
- Regarding publicly disclosed covered data, make reasonable effort to obfuscate or de-identify covered data prior to disclosure
- Make reasonable effort to avoid using or sharing covered data for marketing purposes

NTIA Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

4. Secure Covered Data

- Provide adequate program with administrative, technical, and physical safeguards appropriate to operator's size and complexity
- Model security programs after NIST Cybersecurity Framework

5. Monitor and Comply with Evolving Federal, State, and Local UAS laws

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NTIA Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

- **Supported by:**
  - **Amazon, Association for Unmanned Vehicle Systems International (AUVSI), Center for Democracy and Technology, Commercial Drone Alliance, Consumer Technology Association, CTIA, Future of Privacy Forum, Intel, New America's Open Technology Institute, PrecisionHawk, X (Formerly Google [x]), Small UAV Coalition, Online Trust Alliance (OTA), News Media Coalition, Newspaper Association of America (NAA), National Association of Broadcasters (NAB), Radio Television Digital News Association (RTDNA), Digital Content Next (DCN), Software & Information Industry Association (SIIA), NetChoice, U.S. Chamber of Commerce**

Reducing Privacy Risks for Infrastructure Users of UAS

- **Fly over own land or own right of way**
- **Technological solutions**
  - **https://fpf.org/wp-content/uploads/2016/08/Drones_and_Privacy_by_Design_FPF_Intel_PrecisionHawk.pdf**
- **Provide notice**
- **Privacy policy**
- **Special care if releasing to public**
- **Persistent and continuous uses may pose highest risk (security monitoring)**

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Conclusions

- **Both intellectual property and privacy issues regarding data collected by UAS uncertain**
- **Due diligence required to answer producer questions about their data or required to draft privacy policies challenging in complex technology ecosystem**
- **For tech providers – getting grip on your data flows may become table stakes in precision ag and infrastructure**
- **Participation in standards development and legislative action likely helpful**
- **Focus on user agreements key**
- **Notice, privacy policies and following best practices reduce risk**

Thank You

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This program will resume at 11:00 a.m. CT

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Session 3 – Business Plan Discussion: UAVs – Cutting Edge Applications, Problems, and Solutions

Bridget Hayden, Partner
Dorsey & Whitney LLP
Minneapolis, MN

Aaron Lessig
CEO and Chairman
Pulse Aerospace, Inc.

Eric Taiple
CEOfficer and Cofounder
Sentera, LLC

Eileen Lockhart
Unmanned Aircraft System (UAS) Program Manager
Xcel Energy

Sentera LLC
6636 Cedar Avenue South, Suite 250
Minneapolis, MN 5542
www.sentera.com

sentera

Sentera at a Glance

Our People and Business

- Founded 2014; $8.5M Series A funding
- 25 employees, 75% technical
- More than 200 cumulative years in UAS and remote sensing
- Heritage Lockheed Martin and United Technologies

Our customers

- More than 25 million acres of land imaged and cataloged
- Agriculture, Infrastructure, Public Safety, Environment
- Partners include 5 of the 6 largest crop advisors in N. America
- Users worldwide

Our strategy

- Provide solutions that are simple, elegant, and complete
- Leverage common technology to verticals; remain focused
- Understand value streams; don't compete with customers

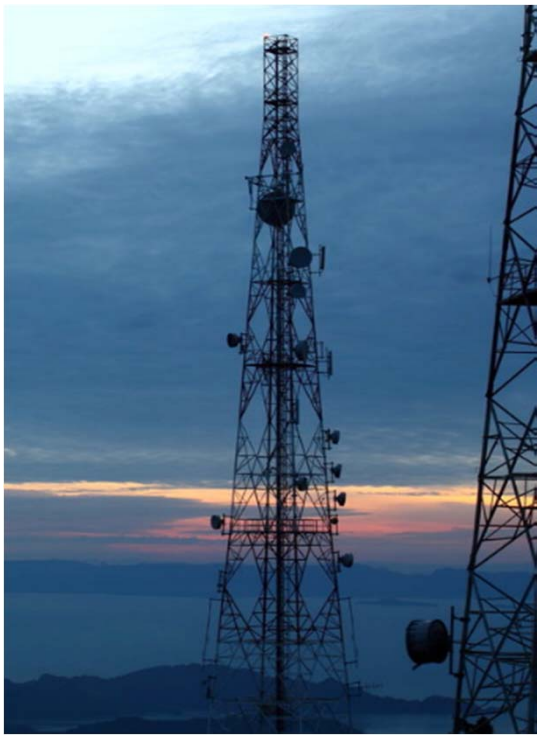
Our mission

- Help scale world food production to meet future needs
- Make dangerous, dull, and dirty jobs less so
- Protect our environment

Markets Served

Agriculture

Infrastructure Inspection



Public Safety

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Sentera is an Integrated Solutions Provider

- A lesson that took years to learn: Customers eventually don't care about drones, or sensors, or processing.
- Customers have problems and questions, and they seek answers that are affordable and easy to use.
- We provide these answers.
- Our solutions almost always use our software and data processing products. Often, they don't use (just) Sentera drones and sensors.
- Our real value is in taking the best components from anywhere and composing them into systems that solve our customers' problems.

Agriculture Products at a Glance

DRONES

SENSORS

SOFTWARE

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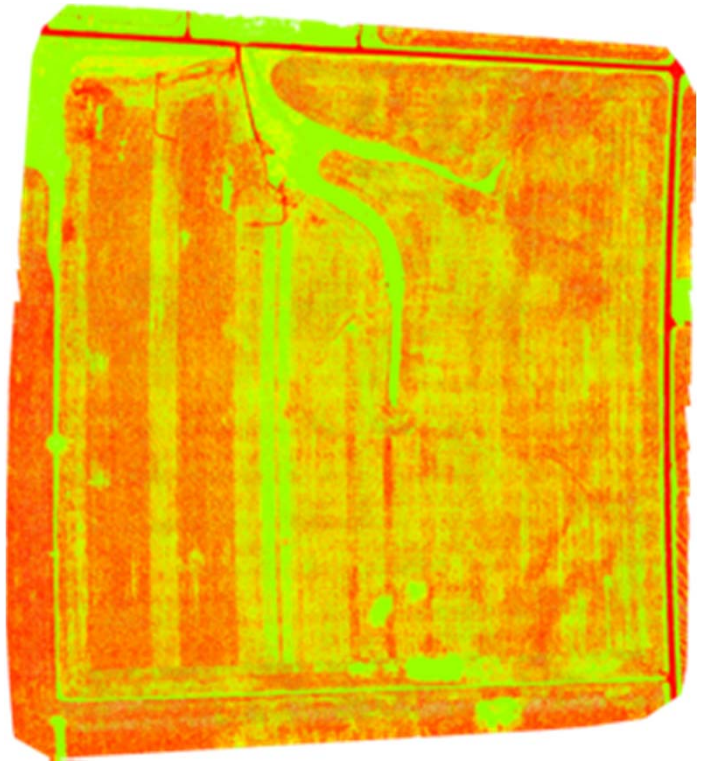
sentera

Drones and Agriculture

- **We’re making crop data more accurate, precise, and immediate.**
- **Today: Mapping crop health with a one hour flight and a few minutes of processing.**
- **Soon: Precision down to the individual plant, delivered in real-time; automated diagnoses of disease, weed species, and pests**
- **Within 5 years, the technical means will exist to cut nitrogen use by more than 40%, and to reduce the use of herbicides and pesticides dramatically, while *increasing* yield.**



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sentera

PULSE™

AEROSPACE

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Pulse Aerospace is the premier developer of Unmanned Aircraft Systems (UAS) technology in the United States. Pulse's HeliSynth™ technology brings formal design workflows to flight control, payload, and performance capabilities historically limited to high cost military vehicles, into commercial markets at relevant price points.

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PULSE™ AEROSPACE

Projects that have Developed Pulse's Technologies

- Aerospace Engineering Firm – 15 Years Experience in UAS Automation and Development
- Automation and Optimization of Complex UAS Systems - Helicopters
- Department of Defense, Skunkworks, DOE, DOI, BLM, Spawar, Numerous Defense Contractors
- 30+ Research Universities
- UAS Platforms Ranging from 30 – 1,200 Pounds
  - Antarctica
  - Greenland
  - Australian Outback
  - Death Valley
  - Kansas!
- Fixed Wing and Helicopter UAS

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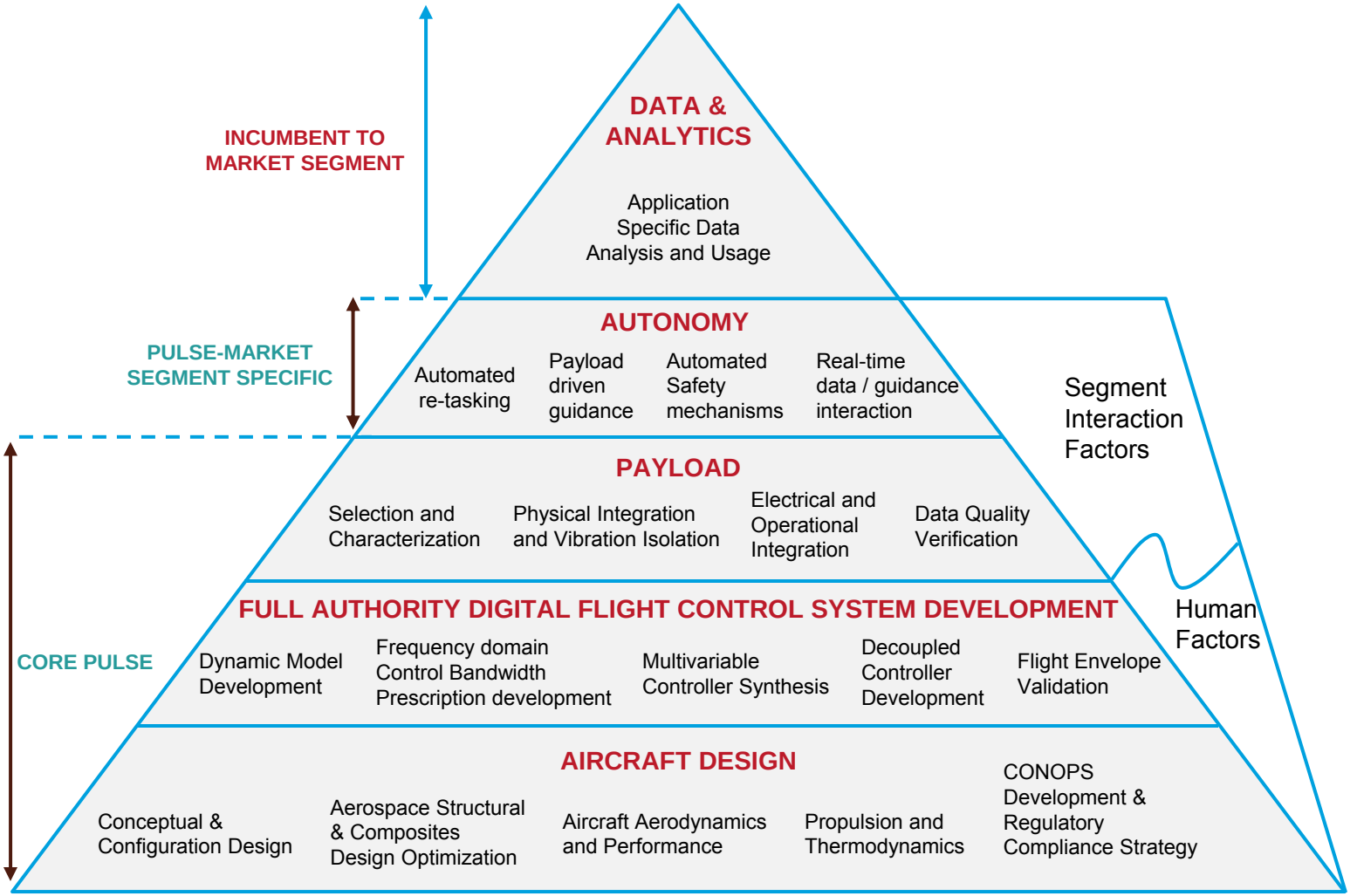
PULSE™ AEROSPACE

Capabilities and Market Access
HeliSynth™



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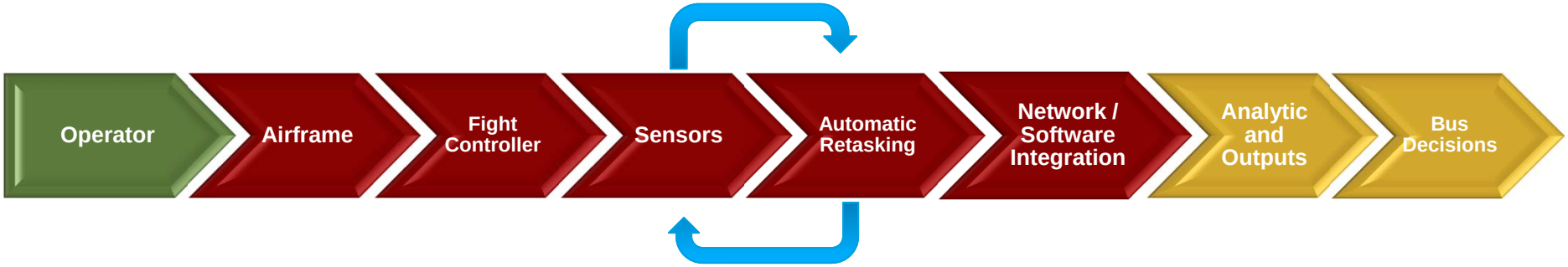
PULSE™ AEROSPACE

Value Stack

Service Provider
Or End-user

PULSE™ HeliSynth™

Business
Intelligence



Business / Decision Workflows

Standard Operating Procedures

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Recent Highlight Projects - Examples

- **First Commercial UAV Gas Leak Detection**
- **First Beyond Visual Line of Site Utility Line Inspection in the US**
- **DOI UAS Contract**
- **First Medical Delivery Beyond Visual Line of Site – State Department and Special Forces**
- **First Commercial UAS “Shark Watch” Patrol in Australia – Little Ripper**
- **30+ Payload Configurations Completed – Hot Swapable on Vapor**
- **Mining, Survey, Agriculture, Infrastructure – Australia, South America, Canada, US**

Recent Highlight Projects – Gas Leak Detection, Shark Watch

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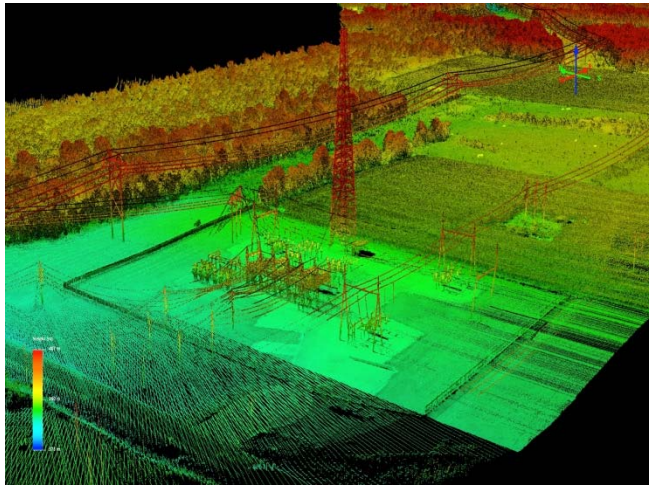
Recent Highlight Projects – Utility (lidar, Inspection, Line Pulling, Ash Dam)



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Recent Highlight Projects – DOS Roof Top Medical Delivery (12 Pounds, 16 miles BVLOS, Fully Automatic)

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Pulse Electric Vehicle Examples

VAPOR 35

GTOW:	35 lbs
Maximum Endurance, Full Payload:	60 min
Useable Payload Weight:	5 lbs
Data Links:	900 MHz, 2.4 GHz, 5.8 GHz, Satellite
Primary Missions:	ISR, Inspetcion, Situational Awareness, Mapping
Stability and Control Power Test:	45 mph
Ground Control:	Live GPS Position, Full Authority Control, Automatic or Manual Flight

Pulse Vehicle Examples

VAPOR 55

GTOW:	55 lbs
Maximum Endurance, Full Payload;	60 min Electric, 3 to 6 Hours Fuel
Useable Payload Weight:	12 lbs Electric, 15 lbs Fuel
Range:	35 Miles Electric, 200+ Miles Fuel
Primary Missions:	Mining, Utilities, Geospatial, Oil and Gas, Logistical Delivery
Data Links:	900 MHz, 2.4 GHz, 5.8 GHz, Satellite
Ground Control:	Live GPS Position, Full Authority Control, Automatic or Manual Flight

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Aircraft Design VR-800 and VR-220

Parameter	VR-800	VR-220
Take Off Weight:	800+ lbs.	220 lbs.
Maximum Payload:	350 -400 Pounds	90 – 100 Pounds
Endurance:	1 – 6 Hours (payload dependent)	1 – 6 Hours (payload dependent)

The configuration of the vehicle is focused at agricultural spraying with removable chemical tanks on either side of the fuselage. Although agricultural spraying is the primary application for this vehicle, it can easily be reconfigured to target other applications that require smaller payloads with longer flight times in the military, public safety, and remote sensing applications.

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Vapor 55 – Sample of Integrated Payloads

CLASS LEADING PAYLOAD FLEXIBILITY

SONY PRECISION MAPPING PACKAGE

SONY PPK MAPPING PACKAGE

PHASE ONE IXU PRECISION MAPPING PACKAGE

PHASE ONE IXU PPK MAPPING PACKAGE

HEADWALL NANO HYPERSPECTRAL IMAGER

YELLOWSCAN LIDAR

TRILLIUM ORION HD-50

RIEGL VUX-1 UAV LIDAR

PHOENIX AERIAL RANGER LIDAR

PHOENIX AERIAL AL3-32 LIDAR

MULTI-PAYLOAD OPTIONS

DROP MECHANISM

Pulse Aerospace, Inc
450 N Iowa St Ste A1
Lawrence, KS 66044
aaronlessig@pulseaero.com
303-619-6330

Xcel Energy's UAS Integration Vision

- **Eileen Lockhart- UAS Program Manager**
- **Wednesday, August 31, 2016**
- **Dorsey UAS Seminar**

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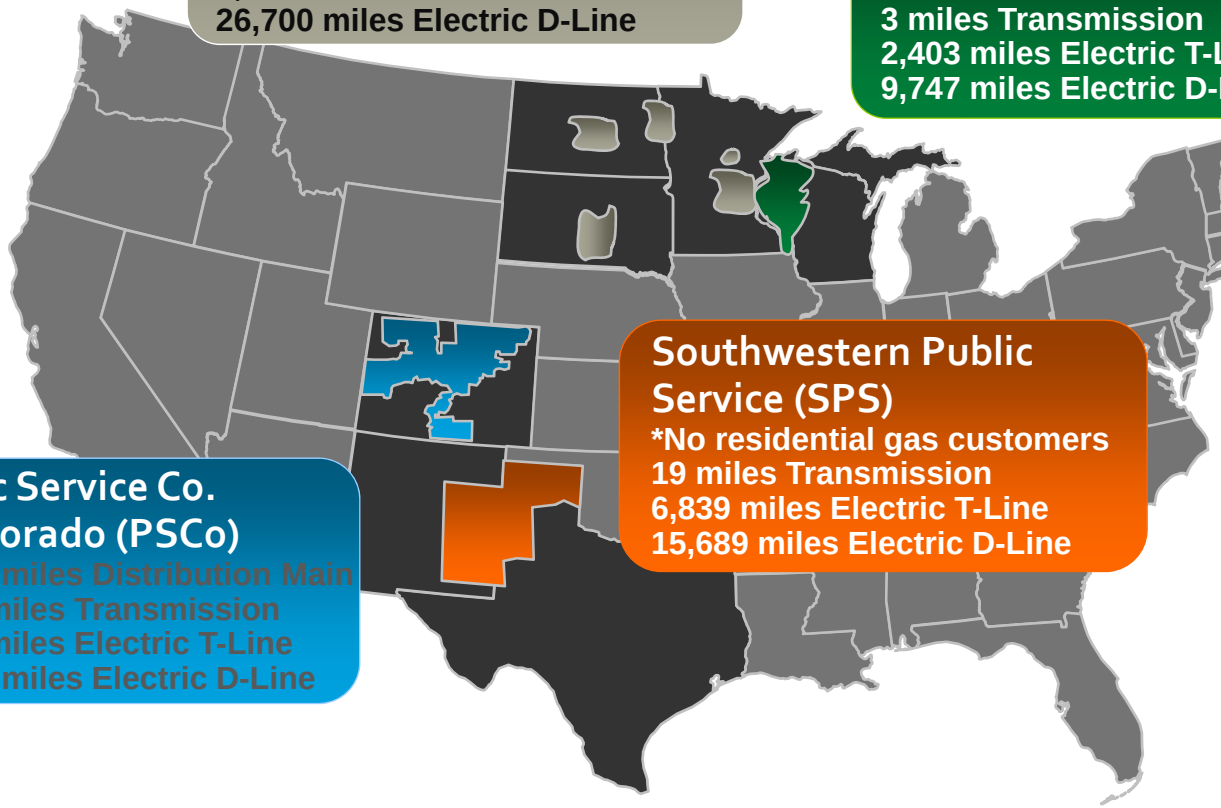
Xcel Energy®

Diverse Operating Areas



NSP-Minnesota (NSPM)
9,843 miles Distribution Main
100 miles Gas Transmission
4,942 miles Electric T-Line
26,700 miles Electric D-Line

NSP-Wisconsin (NSPW)
2,300 miles Distribution Main
3 miles Transmission
2,403 miles Electric T-Line
9,747 miles Electric D-Line

Southwestern Public Service (SPS)
*No residential gas customers
19 miles Transmission
6,839 miles Electric T-Line
15,689 miles Electric D-Line

Public Service Co. of Colorado (PSCo)
22,000 miles Distribution Main
2,000 miles Transmission
4,602 miles Electric T-Line
22,000 miles Electric D-Line

Operate in 8 States

Customers
3.5 million electric
2.0 million natural gas

NSPM = 1.5 million
NSPW = 272,330
PSCo = 1.7 million
SPS = 363,559 (Electric only)

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Technology is Changing

Xcel Energy views UAS technology as transformational and believes it will redefine traditional working methods.

- **Started experimenting with UAV's indoors in 2013**
- **Developed a small internal UAS team in 2014**
- **Evaluated sUAS technology capability**
- **Developed use cases**
- **Shared vision with our internal stakeholders and federal legislators**
- **Partnered with several organizations including:**
  - **EEI, EPRI, INL, IEEE & more**
- **Received an Section 333 exemption & blanket COA in May 2015**

Summer of 2015

Mission planning and mission execution began…

UAS Mission Approach

UAS Program & Operations Office

Dedicated resources to manage VLOS and BLOS operations

Proof of Concept Missions

Execute POC missions and establish lessons learned for implementation

Visual Line of Sight

Internal visual line of sight operations

Beyond Line of Sight

Partner with outside organizations for beyond the line of sight operations

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More than 8 Missions Completed

August 2015 – February 2016

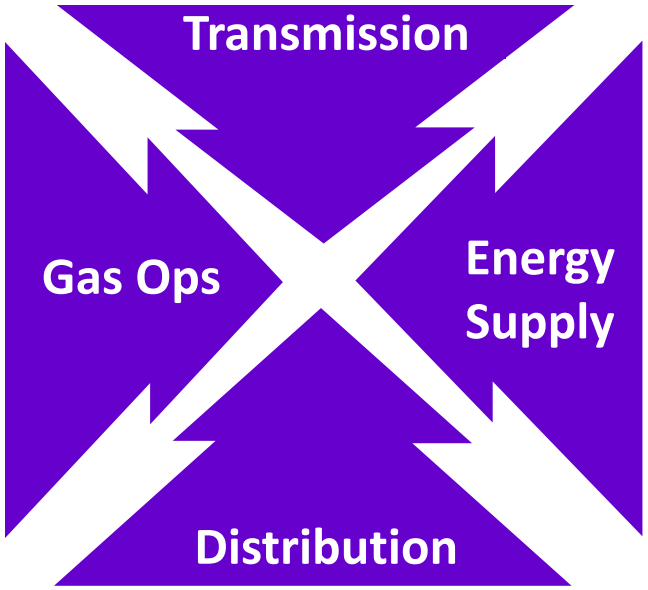
Completed 7+ missions in 2015

Indoors: (performed several to date)

- Boiler inspections (burner fronts)
- Duct inspections (structural)

Outdoors:

- Inspections of five energized substations
- Transmission line inspection
- Volumetric survey of ash storage facility
- Wind turbine blade inspection
- Transmission high pressure gas pipeline & leak detection
- Distribution gas pipeline bridge inspections



Each mission was benchmarked against predefined set of performance metrics

February 3, 2016: Xcel Energy became the first electric utility in the United States to complete an FAA-approved beyond-visual-line-of-site (BVLOS) mission.

UAS TEAM

Completed condition inspection of a 69kV OHTL using two UAS (helicopter and fixed wing).

We couldn't have done this without our partners….

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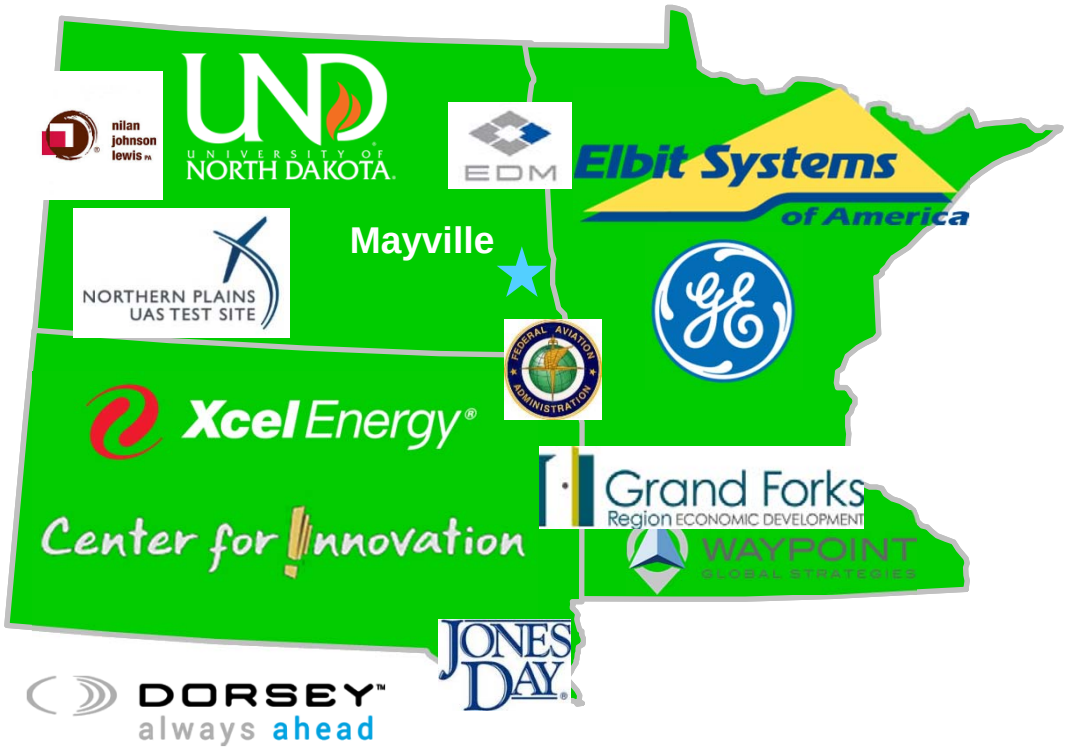
Story time begins…

May of 2016 Xcel Energy established a UAS Program Office within Operations.

The team expanded and now includes a diverse group of multi-disciplinary stakeholders such as:

- ***Operations (enterprise wide), Security, Aviation, GIS/Mapping, Business Systems, Insurance, Business Continuity, Claims, Legal, Training, Sourcing, Strategy & Planning, Communications, Regulatory Affairs, Public Relations and more…***



- **The UAS Program Office and team members partnered with North Dakota Stakeholders and submitted a joint grant proposal to execute a POC Storm Assessment Mission.**
- **The grant partners invested $500K towards the project and was awarded a $500K in matching funds from North Dakota**

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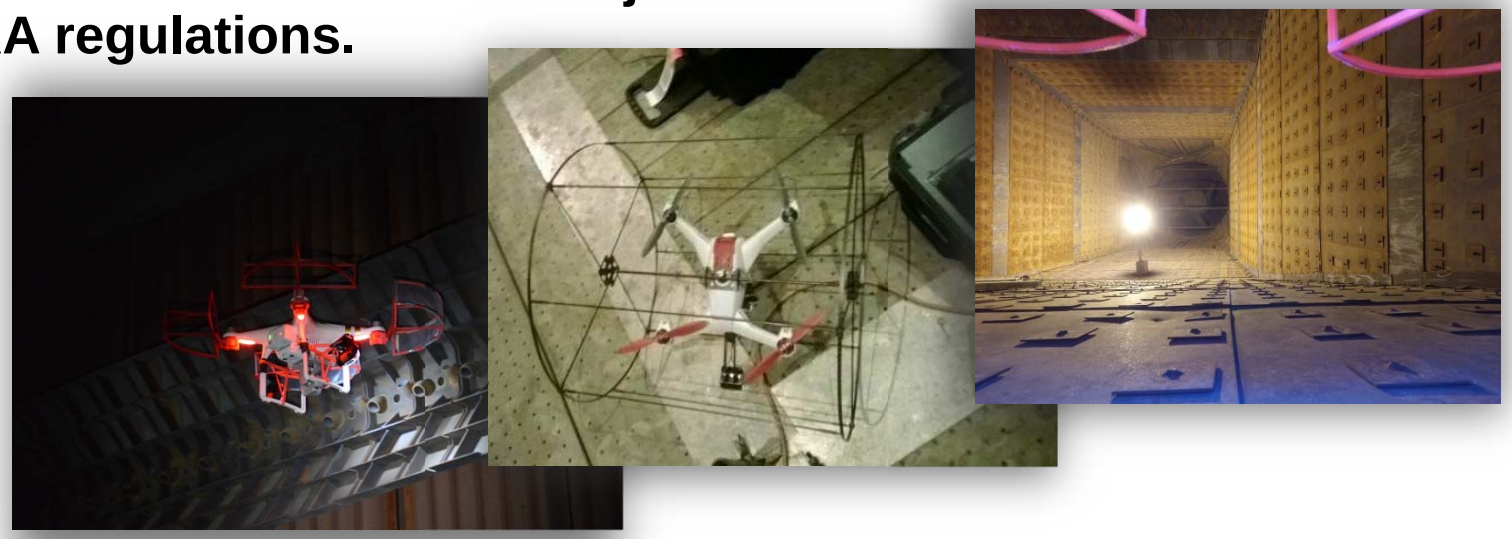
Xcel Energy's UAS Integration Vision

Appendices

Mission 1

- **Boiler Inspections (Indoor)**
  - **Completed condition inspections of boiler burners and overfire airports.**
  - **Structural Duct Inspections (Indoor): Inspections of structural integrity of the internal duct work**
- **Heat Recovery Steam Generator inspections focused on physical damage & insulation placement**
  - **Note: Indoor use is not subject to FAA regulations.**



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Mission 2

- **August 2015 – Substation Data Collection:**
  - **Successfully completed its first outdoor mission.**
  - **The mission focus was to use a small UAV (under 55 pounds) to conduct an inspection of five Amarillo-area energized substations to validate equipment ratings.**
  - **The aerial vehicle, equipped with a high resolution camera, took still photographs of energized electrical equipment nameplate data located high off the ground.**
    - **The data was needed to comply with NERC reliability standards.**

Mission 3

- **October 2015 – Overhead Transmission Line (OHTL) Inspection:**
  - **Conducted an inspection of a seven- mile section of rebuilt 230kV transmission line near the Canadian border in North Dakota to verify compliance with Xcel standards and assess ROW conditions.**
    - **Simulated BLOS operations by using preprogrammed autonomous flight capabilities.**
    - **Pilot intervention was only required for takeoff and landing.**
    - **Planted "defects" to assess image quality and detection capabilities in a blind test.**

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Mission 4

- **October 2015 – Volumetric Survey of Ash Storage Facility:**
  - **Completed a volumetric survey of an ash storage facility southeast of the Twin Cities by using imagery collected while flying preprogrammed transects over the 42 acre site together with Pix4D software.**
    - **In just 11 minutes the UAS generated enough images to develop a three-dimensional rendering of the ash landfill and certify the volume of ash.**
    - **Compared to ½-day minimum (with full-size helicopter and LiDAR).**
    - **Compared to full-day with survey crew.**
    - **Post-mission analysis revealed the accuracy to be within 0.01% of historic methods.**

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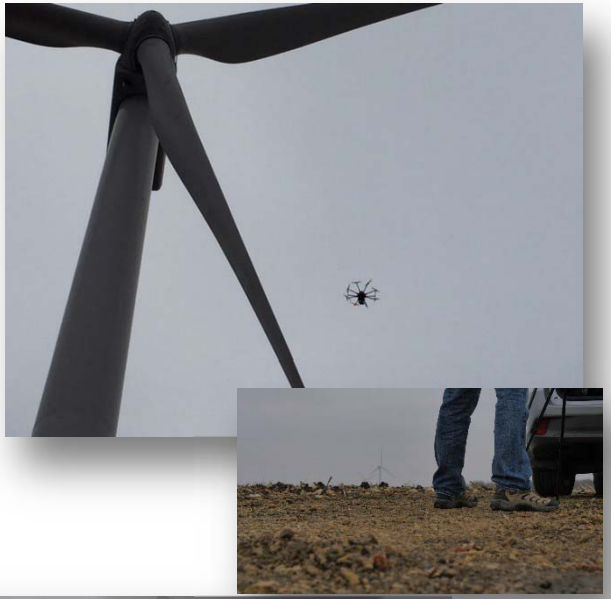
Mission 5

- **October 2015 - Wind Turbine Inspection:**
  - **Completed an inspection of the condition of wind turbine blades, lightning protection systems and protective gel coat at the Grand Meadow wind farm in Minnesota.**
- **Proved the safety benefits and efficiency of using UAS in lieu of climbing methods.**
  - **The inspection was completed in a fraction of the time required to perform a climbing inspection.**
  - **Identified blade damage that required repair.**
- **Proved the effectiveness versus ground-based inspections using binoculars/spotting scopes.**



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Missions 6 & 7

- **November 2015 – Gas Pipeline Inspection (T&D):**
  - Completed condition inspections of exposed sections of T&D pipelines. Also, deployed a gas leak detection sensor for the transmission pipeline inspection.
- **Transmission Pipeline:**
  - Simulated BLOS operations by using preprogrammed autonomous flight capabilities. Pilot intervention was only required for takeoff and landing.
  - Planted “defects” to assess image quality and detection capabilities in a blind test.
  - Successfully detected simulated gas leaks
- **Transmission and Distribution Pipelines:**
  - Proved capability to assess pipeline and ROW conditions.

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Mission 8

- **February 2016 – BLOS OHTL Inspection:**
  - **Completed condition inspection of a 69kV OHTL using two UAS (helicopter and fixed wing).**
- **First FAA-approved BLOS mission by an electric utility in the U.S.**
  - **Aircraft remained aloft for 60 minutes during the longest duration flight.**
  - **Employed a higher resolution camera than used in previous missions thereby further improving imagery (analysis still in the works).**
  - **Overlapping images were captured to enable 3D modelling of both the line and a substation with Pix4D (analysis still in the works).**

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New York CLE Code

We have some NY lawyers participating remotely today. In accordance with NY CLE Rules, the New York Verification Code for this program is _____.

Use of UAVs

- **What are UAVs being used for right now?**
- **How will the newly-implemented FAA rules change the way UAVs are used?**
- **Other than the FAA rules, are there other sticking points, legal or otherwise, that are preventing you from using UAVs for any application you can imagine?**
- **What are your thoughts on maximizing the utility of UAVs while still ensuring safety?**

UAV Technology

- **Do you see any barriers or problems to UAV technology that need solving to increase their compliance with the FAA rules and/or the efficacy of their use in commerce?**
  - **Precision agriculture**
  - **Energy-related issues**

UAV Industry Intersections and Contrasts

- **How do the use cases overlap/differ by industry - agriculture, energy, other infrastructure, insurance, disaster/search and rescue, mining, etc.?**
- **Are legal concerns the same or different across industries?**
- **What unique challenges/opportunities are presented in these different industries?**

The Future of UAVs

- **Describe the key focus areas for industry groups right now in terms of promoting and expanding use of UAVs**
- **Flash forward five years – where do you think the industry will be?**
- **Do you foresee a legal evolution promoting the use of, or conversely, restricting the use of UAVs?**

Questions

Thank you for joining us today. If you have any questions, please don't hesitate to contact the speakers below.

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Thank you again for joining our drone program today!

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