



# **Full Scale Operational Deployment of Unmanned Aircraft Systems for Multispectral Imagery, LiDAR, and Aerial Applications**

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## Real World Operational Uses

- Herbicide - Invasive Aquatic Weeds –  
St. Johns River Water Management District, FL
- Pheromone  
Vineyard Management - Napa County, CA
- LiDAR, Multispectral Imagery, Aerial Applications –  
California State Parks
- Herbicide  
Invasive Weed  
Solano  
Invasive Weed and Right of Way Encroachment - Bartow, FL
- Vector Control  
Seminole County, FL

# TOPICS

- Key Advantages of Unmanned Aircraft Systems (UAS)
- PrecisionVision® Unmanned Aircraft PV35X and PV40X

# Key Advantages of UAS for Aerial Applications

**Enhanced Safety for Ground Crews**

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**Efficacy / Precision Applications**

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**Accessibility**

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**Efficiency**

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**Environmental Footprint**

Endangered Species, Sensitive Terrain, Fuel



# PrecisionVision® Aircraft 40X & 35X





# PrecisionVision® 35X UAS



- Fully autonomous or manual flight modes
- Flight plans created in the field or in any GIS system
- Three payload systems (liquid, granular, ULV)
- Payload weight capacity 25 pounds
- Typical acres treated per minute 0.3 – 0.5
- Many safeguards, low battery, lost link, spray override, obstruction avoidance, battery failsafe, GCS failsafe





# PrecisionVision® 40X UAS

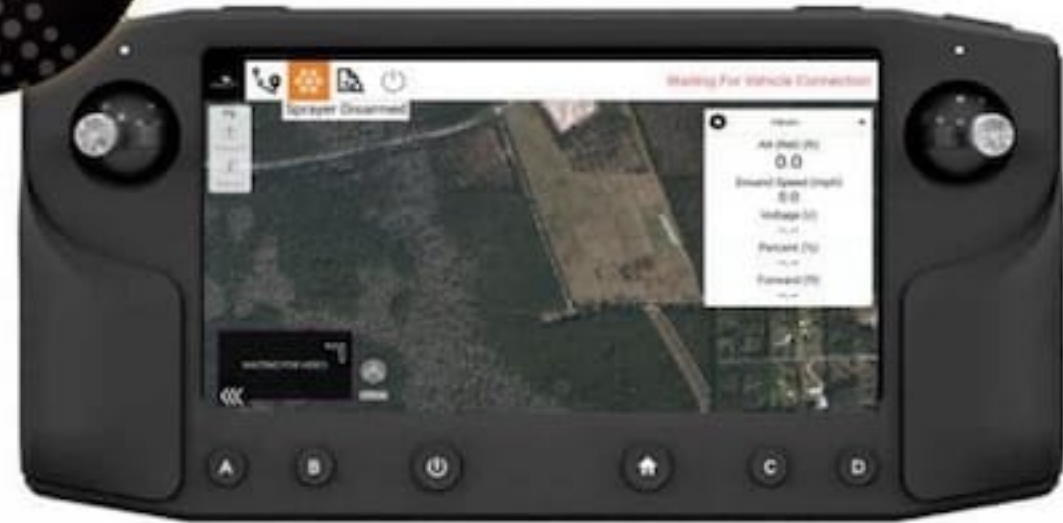


- Fully autonomous or manual flight modes
- Flight plans created in the field or in any GIS system
- Three payload systems, liquid, granular and ULV
- Payload weight capacity 40 pounds
- Typical acres treated per minute 0.5 - 0.7 liquid, 1.5-3 acres/min granule
- Many safeguards, low battery, lost link, spray override, obstruction avoidance, battery failsafe, GCS failsafe



# PrecisionVision Ground Control Station

- Pre-flight checks
- Flight planning
  - Points, path, polygon
- Treatment polygons
  - Import shapefiles
  - Save flight plans
- Application rates
  - Reside in material database
  - Swath
  - Speed
  - Application rate
  - Total spray time
- Material selection database
- Post-treatment log files
  - Shapefiles
    - Points
    - Swath





# **Real World Operational Uses of Drones**

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## **Noxious & Aquatic Weeds**



# Aquatic herbicide applications

## St Johns River Water Management District-Brevard County, Florida

- Canal 90 ft x 4,800 ft
- Large trees line both sides
- UAS swath 16-20 ft
- Near residential area (noise, drift considerations)
- Target: Hydrilla, Water Lettuce, Crested Floating Heart

Why UAS? Relatively small acres, sensitive habitat, residential encroachment, affordable

Time savings 3-4 hours vs. two employees, airboat, loud, near neighborhood and 8-10 hr. day





# Aquatic herbicide applications

St Johns River Water Management District-Brevard County, Florida





# Aquatic herbicide applications Birds and Safety

St Johns River Water Management District-Brevard County, Florida





# Real World Operational Uses of Drones

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## Pheromone Applications



# Pheromone applications

## Napa Valley, California 2022 Vine Mealybug

- Damage by the vine mealybug is like that of other grape-infesting mealybugs in that it produces honeydew that drops onto the branches and other vine parts and serves as a substrate for black sooty mold
- Biological control
- Organic methods
- Mating disruption – applying Checkmate Dry Flowable, one ounce to the acre, as applied at 3 GPA



\* Checkmate is a product of Sutterra, Inc. <https://www.sutterra.com/>



# Pheromone applications

Napa Valley, California 2022 Vine mealybug application of Suterra Checkmate DF





# Pheromone applications Terrain Following Radar

Napa Valley, California 2022 Vine mealybug application of Suterra Checkmate DF







# **Real World Operational Uses of Drones; Imagery, Lidar, Aerial Applications**

## **Noxious Weeds, California**



# Lidar Multispectral Imagery and Applications

## Invasive weed – Cortaderia jubata (Jubatagrass)

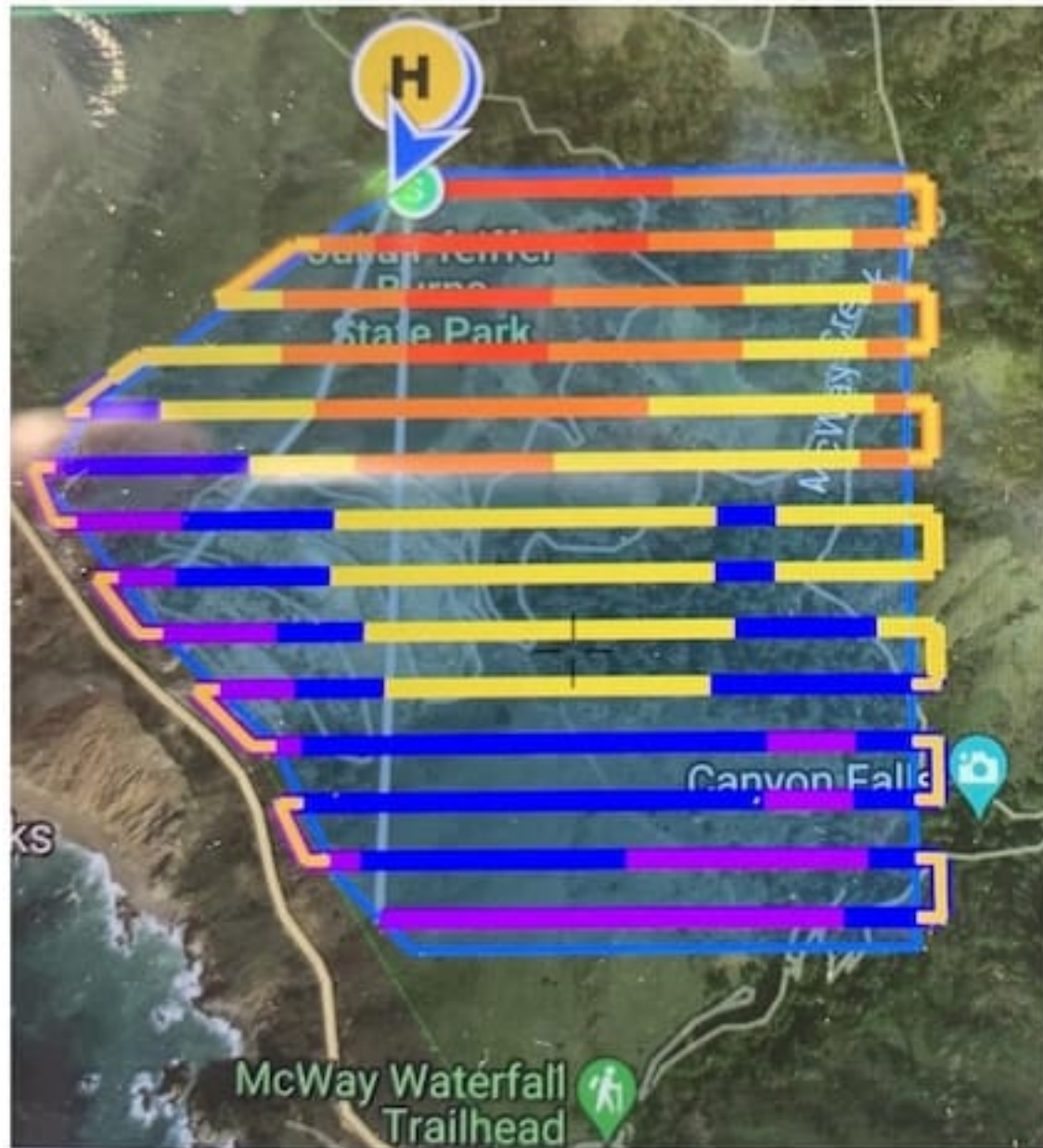
- After the 2020 fires in Big Sur, Julia Pfeiffer and Limekiln State Parks, Jubatagrass established itself along the coast
- 2022 Deployed Multispectral and LiDAR UAS services to identify the exact locations (3cm accuracy using RTK) of the Jubatagrass
- Spring of 2023 UAS aerial applications begin





# Herbicide applications – Invasive Species

California Parks, Big Sur, California; Imagery & LiDAR flight planning





# Herbicide applications – Invasive Species

California Parks, Big Sur, California; First target Jubadagrass





# Herbicide applications – Invasive Species

California Parks, Big Sur, Ca.; First target Jubadagrass – only 1/3<sup>rd</sup> of park 943





# Herbicide applications – Invasive Species



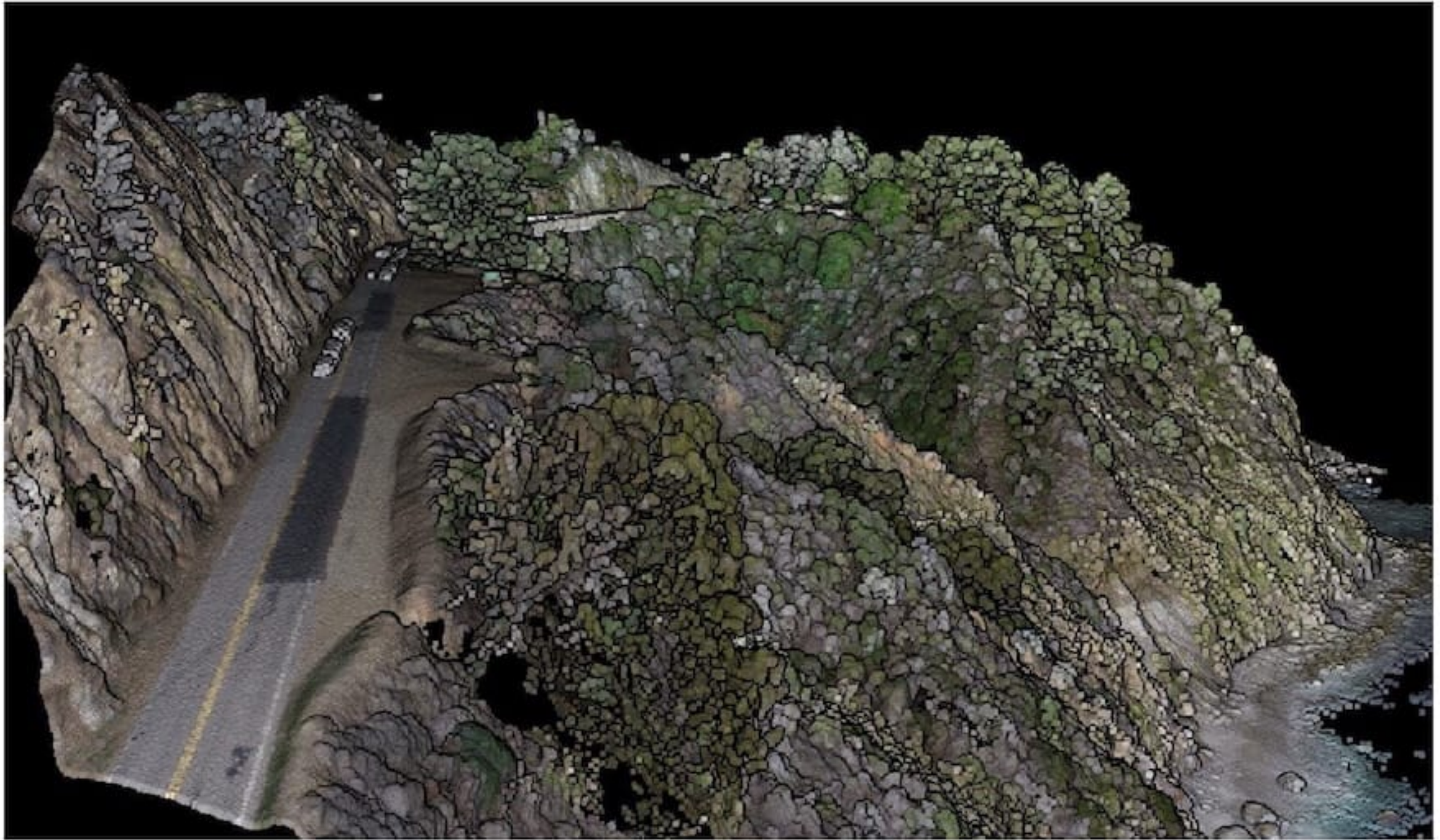






# Herbicide applications – Invasive Species

California Parks, Big Sur, California; First target Jubadagrass





# Herbicide applications – Invasive Species

California Parks, Big Sur, California; First target Jubadagrass





# Herbicide applications – Invasive Species

**Solano Resource Conservation District, Solano, Ca.**

## Vision and Mission Statement

“Improve programs and services to provide the Suisun Marsh land-owners technical assistance in environmental permitting, habitat management, water control, and funding to ensure the wetland and wildlife values of the Suisun Marsh are sustained and enhanced”

Invasive weeds:

Phragmites  
Lepidium





# Herbicide applications – Invasive Species

Solano Resource Conservation District, Solano, Ca.





# Herbicide applications – Invasive Species

Solano Resource Conservation District, Solano, Ca.





# Herbicide applications – Invasive Species

Solano Resource Conservation District, Solano, Ca.







# **Real World Operational Uses of Drones; Precision Spot Treatment Weeds**

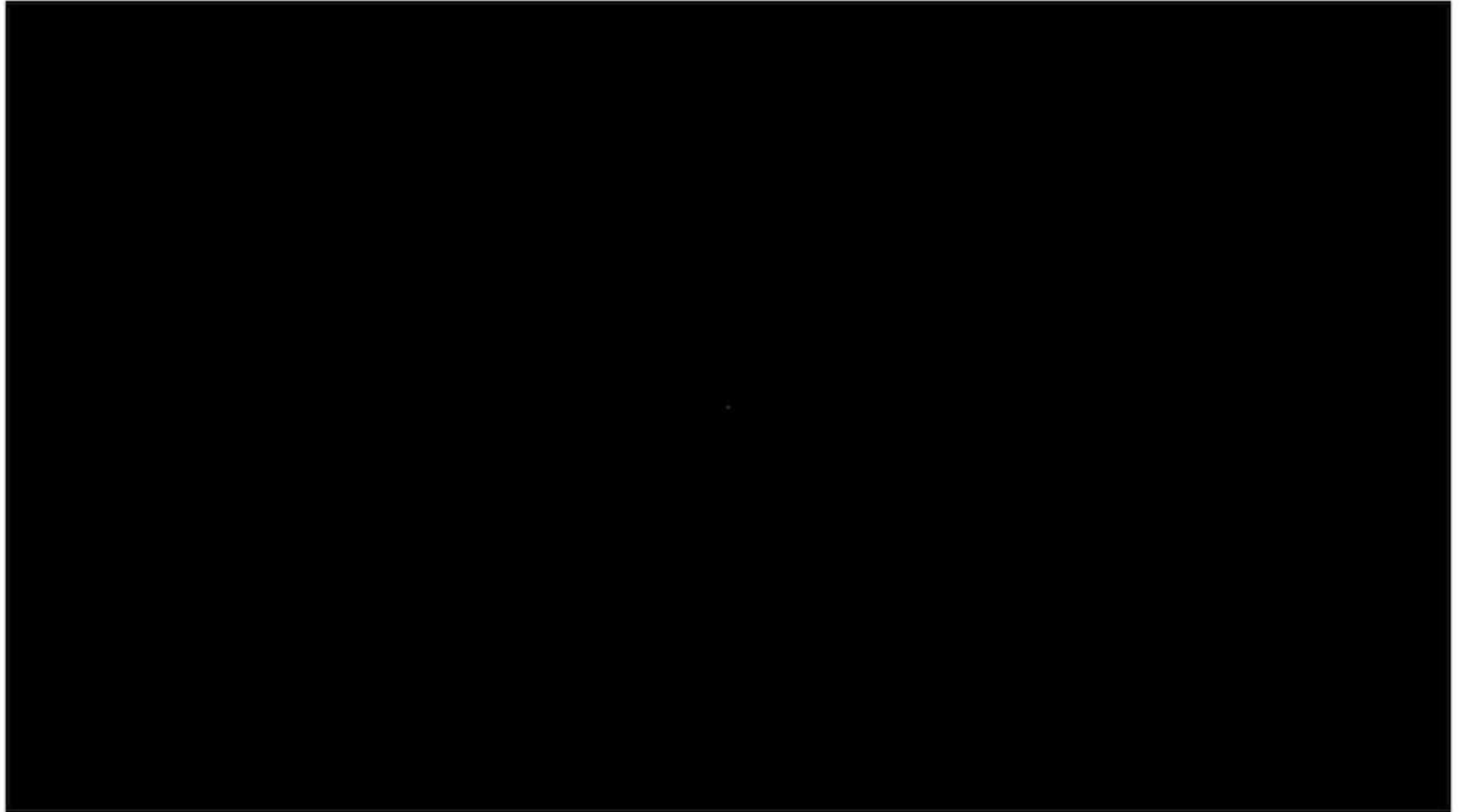
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**USDA, Virginia Tech, Mississippi  
State, Univ. of Nebraska**



# PrecisionVision sub-centimeter spot spraying

USDA College Station Texas and Virginia Tech





# PrecisionVision sub-centimeter spot spraying

USDA College Station Texas and Virginia Tech







# Real World Operational Uses of Drones

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## Mosquito Control



# Product Labels

## "Rotary Aircraft"

Some states are placing UAS under umbrella of "Rotary Aircraft"

## "Unmanned Aircraft"

Product Example: Altosid SR-20



PREVENTS ADULT MOSQUITO EMERGENCE (including those which may transmit West Nile virus, Zika, chikungunya and dengue)

For control of mosquito larvae using ULV application

### SPECIMEN LABEL

#### ACTIVE INGREDIENT:

(S)-Methoprene (CAS #65733-16-6).....20%

OTHER INGREDIENTS:.....80%

TOTAL:.....100%

Formulation contains 1.72 lb/gal (205.2 g/liter) active ingredient

If in eyes • Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.

If on skin or clothing • Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes.

Have the product container or label with you when calling a poison control center or doctor, or going for

For aerial application to terrestrial sites, apply by fixed wing or rotary aircraft. Apply at the rate of  $\frac{3}{4}$  – 1 fluid ounce of product to acre diluted with water at a minimum of a 1:1 mix ratio with water. Apply using ULV equipped and capable aircraft. Unlike ULV sprays targeting flying mosquitoes, it is important that spray droplets deposit in targeted areas. Target terrestrial areas where mosquitoes breed. These sites include tires, open containers, garbage bins, birdbaths, and gutters holding small amounts of water. Spray equipment must be adjusted so that the volume median diameter (VMD) produced ranges from 60 microns ( $Dv_{0.5} < 60\mu$ ) to 100 microns ( $Dv_{0.5} < 100\mu$ ), and that 90% of the spray is contained in droplets smaller than 200 microns ( $Dv_{0.9} < 200\mu$ ). Directions from the equipment manufacturer or vendor, pesticide registrant, or test facility using a wind tunnel and laser-based measurement instrument must be used to adjust equipment to produce acceptable droplet size spectra. Application equipment must be calibrated annually to confirm that nozzle flow rate(s) are accurate. Do not apply at altitudes below 100 feet unless using unmanned aircraft designed for low application heights. Apply when wind speed on the ground is  $\geq 1$  mph and  $\leq 10$  mph. Apply when wind factors promoting drift are low. For best results, use Global Positioning System (GPS) equipped aircraft.



# COLORADO Animas Co. Mosquito Control

## Larviciding flooded pastures near Animas River





# CALIFORNIA Delta Mosquito & Vector Control

## Larvicide and adulticide in corn fields





# Delta MVCD

## Larvicide Application



**Mosquitoes**

*Culex tarsalis*  
*Culex quinquefasciatus*  
*Culex stigmatosoma*



**Altosid XRG  
Ultra**

Applied at  
10 lbs./acre



**Why UAS?**

- Needed to penetrate dense corn canopy
- Larval surveillance extremely difficult
- Residential habitat
- Affordable







# Delta MVCD

## Adulticide Application



### Mosquitoes

*Culex tarsalis*  
*Culex quinquefasciatus*  
*Culex stigmatosoma*



### Pyronyl 525

Applied at  
0.0025 lbs./acre  
(0.8 oz/min)



### Why UAS?

- Needed to penetrate dense corn canopy
- Residential habitat
- Affordable
- A manned contractor for aerial ULV has never been used by Delta



# Delta MVCD

## ULV application

**Site Type:** Corn fields

**Acres Treated:** Adulticide 160 & 82 acres

### Application configurations:

- PV35X
- Micronair nozzles
- 75' AGL release height @ 12 mph
- 300' swath, 7.72 acres/min

### Efficacy test:

- 10 droplet collection stations
- 20-25 wild caught adult *Cx. quinqs.* in field cages at each station





# Delta MVCD

## UAS Application

### Results:

**Mosquito abundance:** 50% reduction of adults in traps after first control treatments

- Continue to monitor trap counts for Altosid residual effectiveness\*

### West Nile infection rates:

- Definite reduction in treatment area of infected *Culex tarsalis* pools; some reduction in *Culex quinqs*.\*

*(WNV MIRs were >20% in pools within corn field prior to UAS application)*

*\*Data still under review*





# Florida

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## Mosquito Larvae

*Aedes infirmatus*  
*Anopheles crucians*  
*Culex nigripalpus*  
*Psorophora ferox*



## Altosid P35

Applied at  
7 lbs./acre



## Why UAS?

- Relatively small acres
- Sensitive habitat
- Residential encroachment
- Affordable



**FLORIDA**

# Seminole County Mosquito Control

**Site Type:** Woodland freshwater

**Acres Treated:** 389.00 acres

## Application configurations:

- PV35X, granular payload system
- 17 mph, effective swath width 80'

**Acres treated/minute:** 2.75

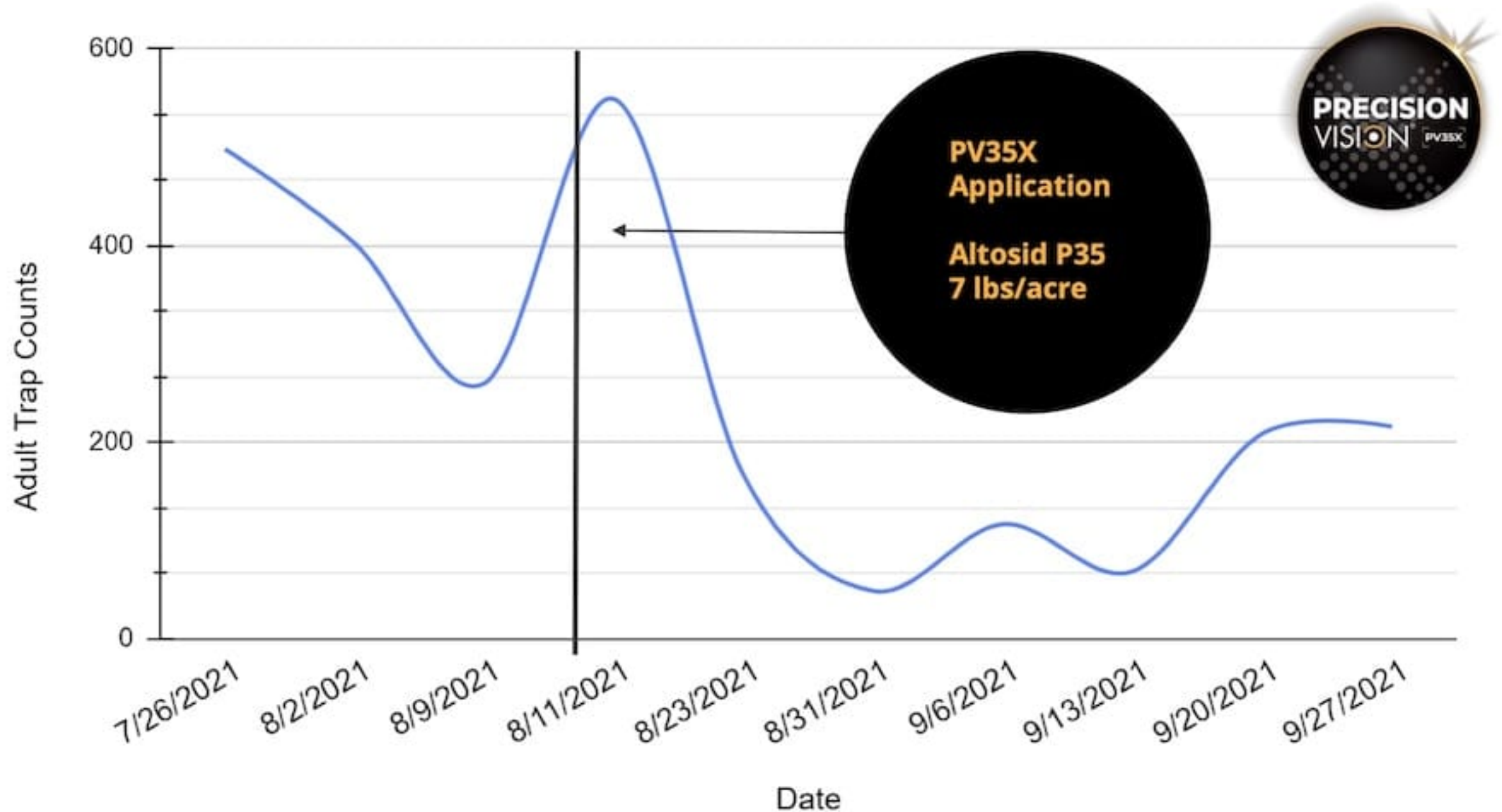
**Granular flow rate:** 19.23  
lbs./min





# 2021 Adult Mosquito Counts via CO2 Baited Trap

## Seminole County, FL





**We can help you make unmanned aerial systems  
an important part of your operations!**





# Thank You

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