



# **Unmanned Aircraft Systems for Aerial Applications**

LeadingEdge

 **YAMAHA**





- **Yamaha unmanned helicopters have been used commercially for spraying since 1991**
- **Yamaha has released 3 separate platforms:  
R-50 (1991)**
- **RMAX (1997) & RMAX Type IIG (2003)**
- **FAZER (2014) & FAZER R (2016)**
- **Yamaha has produced over 5,000 helicopters and have over 2 million flight hours**
- **Yamaha unmanned helicopters spray over 2.5 million acres annually**





- **Currently over 40% of all rice paddies in Japan are sprayed by a Yamaha unmanned helicopter**



- **Currently authorized to be used in Japan, Korea, Thailand, Australia, New Zealand and the United States**











- **2017 was the first season offering commercial services**
- **Conducted active spray studies with UC Davis since 2015**
- **RMAX unmanned helicopter**
- **Viking VI that serves as our loading platform**
- **Roles**
  - **Pilot (per current California laws the pilot must be commercially rated)**
  - **Visual Observer (no requirement other than Yamaha training)**

## **SETUP (45 mins)**

- **Unload equipment**
- **Prepare units**
- **Preflight checklist**
- **Morning briefing (huddle)**

## **SPRAY**

- **1 – 3 acres per hour**
- **10 gallons per acre**
- **Includes time for mixing & loading**
- **Backpack areas not accessible by helicopter**
- **10-12 mph**
- **10' above canopy**





**CLEANUP (30 – 45 mins)**

- **Triple rinse**
- **Clean in field**



## Autopilot

- **Exact terrain following allows for automated flight**
- **Reduce operator fatigue**
- **Allows for spot applications**
- **Will integrate into operations in 2018**

## FAZER R

- **Type Certify FAZER R with FAA**
- **Lease FAZER R to qualified organizations**
- **Carries 8.5 gallons (double the RMAX)**
- **Plan to begin offering lease in 2019-2020**

### AUTOPILOT PRECISION FEATURES



EXACT TERRAIN FOLLOWING



ACCURATE COURSE NAVIGATION



AUTOMATED CROP SPRAY



- **Multi-Rotor**
- **Yamaha introduced a multi-rotor unit in Japan (October)**
- **Under 55 pounds**
- **Battery powered with 2 gallon payload**





# MG-1 and MG-1S Unmanned Aircraft System (UAS)

- 1 to 4 Teejet nozzles
- 22 pound payload
- 10 liter spray tank
- Gross weight 54 lbs.
- Flow rates 12 – 128 ounces / minute
- Variable rate flow control
- Autonomous or manual flight plan
- RTK –Real Time Kinematic GPS
- Absolute RTK correction
- Flight time duration 12-15 minutes
- Treat .5 - .8 acres per minute
- Fully integrated with real time tracking and positioning
- Variable rate flow control







**If you are going to perform aerial applications,  
you better know your droplet spectrum,  
effective swath width and cross wind swath**





















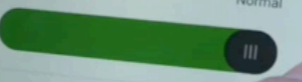






Self-check Before Takeoff

- MG-1S GPS Signal Good
- Radar Normal
- Spray system Normal



Cancel

S  
M  
M+





## PRECISION FORESTRY



# Pacific Northwest

- Custom Forestry application for site prep
- Removes plant competition
- Seeding performed by Drones also
- Reforestation without extensive labor as in the past
- Operator can operate multiple drones at once



# THE **FIRST** FAA APPROVED SWARMS FOR SPRAYING

We're working with commercial foresters to make reforestation more efficient. Offering a one-stop solution, our team of drones plants tree seeds and sprays fertilizer and herbicides to keep trees healthy.

Millions of acres of forestland are currently under-utilized. The availability of dependable workers, and the safety concerns of rough terrain, prevent trees from being planted and cared for. DroneSeed is a scalable solution to addressing this problem. This is the future of forestry - faster, safer, and more efficient.







# *UAS FAA Laws & Requirements*

*It's Complicated*



# 14 CFR Part 107

- FAA promulgated rules in 2016 due to increase of Drone use
- sUAS Small Unmanned Aircraft System < 55 pounds for commercial purposes
- Can't carry or dispense hazardous materials  
"Economic poisons"
- Can get waivers by FAA but can take along time to get.  
Public entity COA faster



# 14 CFR Part 137

- Agricultural Aircraft Operations
- UAV > 55 pounds
- Same as traditional aerial applicators
- Can apply economic poisons
- Exemptions from wearing harness and certain maneuvers



- The FAA grants relief from certain sections of 14 CFR part 137 that are not applicable to small UAS
- Section 107.36 states that; a small unmanned aircraft may not carry hazardous material. For purposes of this section, the term hazardous material is defined in 49 CFR 171.8
- Knowledge and skill tests - Chief pilot supervisor of agricultural aircraft operations knowledge and skill regarding agricultural aircraft operations
- The test of skill consists of : Approaches to the working area, flare pullups and turnarounds.

## Established comprehensive pilot and visual observer (VO) training

- A pilot proficiency demonstration;
- Supervised flight training including agricultural spraying;
- Droplet assessment
- Completion of the training program requirements including examination;
- Continued periodic training even after certification.



- One person who holds a current U.S. commercial or airline transport pilot certificate and rating for the aircraft to be used
- The remote PIC must hold a remote pilot in command certificate (RPIC) with a small UAS rating in accordance with 14 CFR part 107. However, when conducting commercial agricultural aircraft operations, 14 CFR part 137 requires the PIC to hold at least a commercial pilot certificate, and meet all requirements of 14 CFR part 137 unless exempted.
- When a person manipulating the controls of the small UAS is not the remote pilot in command, as permitted in accordance with § 107.12(a) (2), he or she must be supervised by a remote pilot in command who meets the applicable knowledge and skills requirement for agricultural aircraft operations

# Recommendations for State Agricultural Policies:

## Private applicators:

- Adopt Federal FAA requirements

  - Require FAA Part 137 Certificate

  - Pilot, sport, recreational pilot license

  - Chief pilot with Part 137 Credentials

  - FAA Part 107 sSUS pilot license

## Public Agencies:

- FAA Part 107 sSUS pilot license

- Applicators license (ground)

- Operate as public use aircraft



# North Carolina Issues

- Must have Aerial Applicator license and Contractors license
- Specialty category (Forestry, Ag Pest Plant)
- Apprenticeship of 125 hours under licensed pilot
- No deposit zones ( 25 feet from road edge, 100 feet from residence and 300 feet from occupied business.
- Drones can be a precision application method, not practical for our regs

# Other considerations

- Is a Drone a Helicopter?
- Does Aerial Application on the label cover it?
- Labels will need to specify
- Droplet size documentation
- Is a Drone safer thus minimizing risk. Less stringent no deposit areas.



# Questions

