Agricultural Aircraft Operations Regulations and Exemptions

Big Island Weed Management & Restoration Forum

Roberto Rodriguez III
Aeronautical Sciences Department
University of Hawai‘i at Hilo

10/23/2024

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Federal Aviation Regulations

- Title 14 Code of Federal Regulations (14 CFR)
  - Part 47: Aircraft Registration *(UAS > 55 lbs)
  - Part 48: Registration and Marking Requirements for small Unmanned Aircraft *(sUAS < 55 lbs)
  - Part 91: General Operating and Flight Rules *(UAS > 55 lbs)
  - Part 107: Small Unmanned Aircraft Systems *(sUAS < 55 lbs)
  - Part 137: Agricultural Aircraft Operations

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Exemptions are Necessary

- 14 CFR §107.36. A small unmanned aircraft (sUA) may **not** carry hazardous material
- 14 CFR §137.3. Agricultural aircraft operation means the operation of an **aircraft** for the purpose of dispensing (1) economic poison(s), (2) dispensing any other substance intended for plant nourishment, soil treatment, propagation of plant life, or pest control, or (3) dispensing activities directly affecting agriculture, horticulture, or forest preservation
- sUA and UA are **aircraft**. When used in agricultural aircraft operation they must adhere to the limitations in 14 CFR §137.

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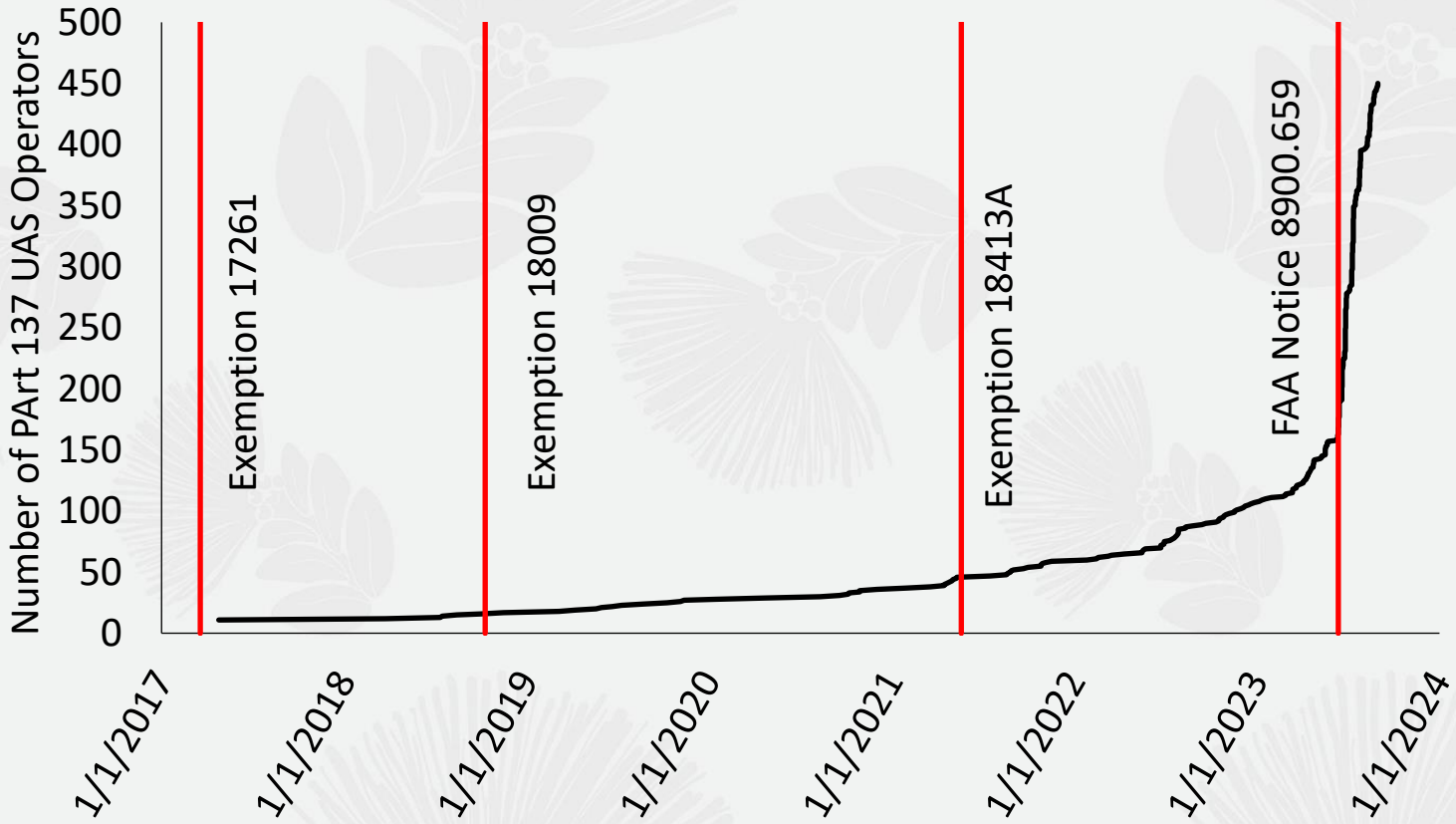
Evolving Regulations Increased Number of Operatos



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Exemption Process

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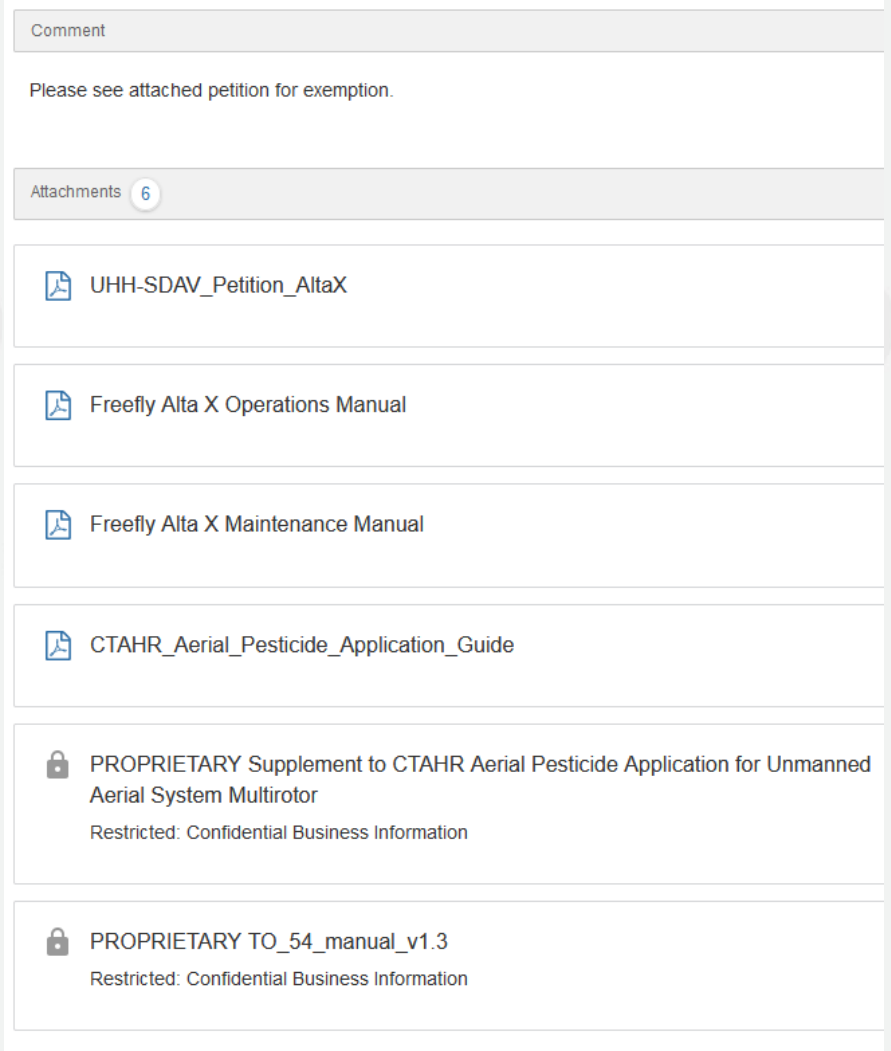
Exemption Type Flowchart

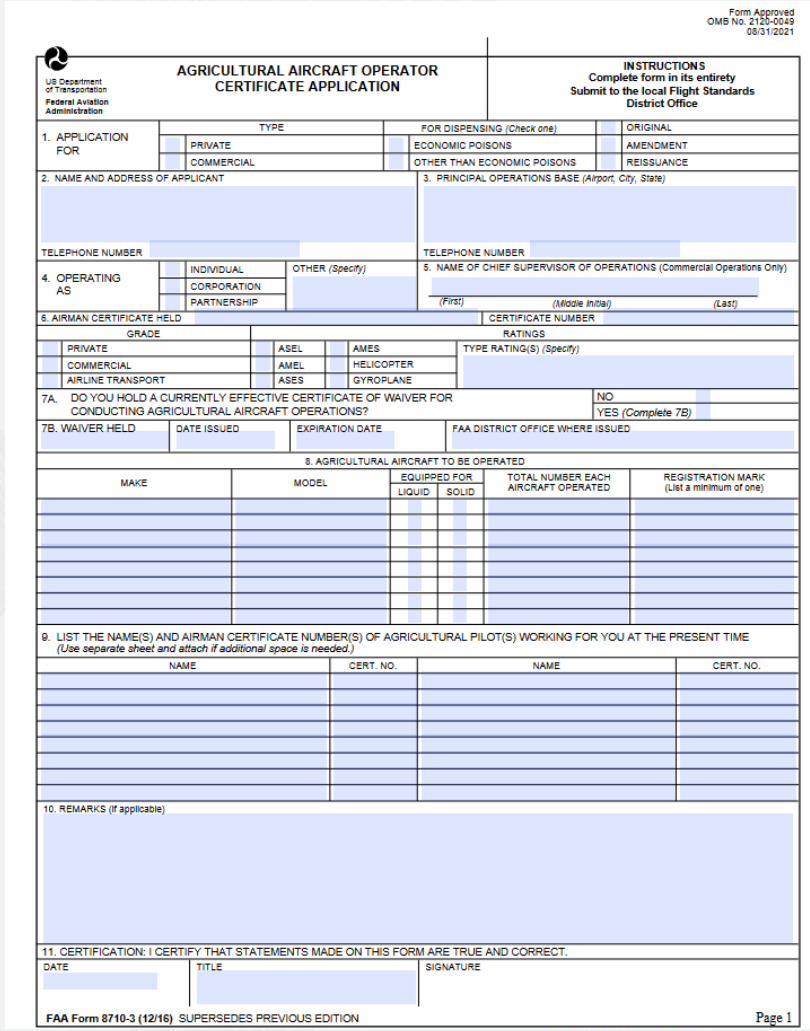
Things You Need to Submit

- Petition for Exemption
- UAS Operating and Maintenance Manuals
- Application Equipment Manual (if separate)
- Operator Training Manuals



Once You Have Your Exemption

- Apply for Agricultural Aircraft Operator Certificate
- Need:
  - Exemption
  - Chief Supervisory Pilot
  - At least one registered UAS equipped for agricultural applications



Form Approved
OMB No. 2120-0049
08/31/2021

US Department of Transportation
Federal Aviation Administration

AGRICULTURAL AIRCRAFT OPERATOR CERTIFICATE APPLICATION

INSTRUCTIONS
Complete form in its entirety
Submit to the local Flight Standards District Office

1. APPLICATION FOR — TYPE: PRIVATE, COMMERCIAL; FOR DISPENSING (Check one): ECONOMIC POISONS, OTHER THAN ECONOMIC POISONS; ORIGINAL, AMENDMENT, REISSUANCE

2. NAME AND ADDRESS OF APPLICANT — TELEPHONE NUMBER

3. PRINCIPAL OPERATIONS BASE (Airport, City, State) — TELEPHONE NUMBER

4. OPERATING AS — INDIVIDUAL, CORPORATION, PARTNERSHIP; OTHER (Specify)

5. NAME OF CHIEF SUPERVISOR OF OPERATIONS (Commercial Operations Only) — (First) (Middle Initial) (Last)

6. AIRMAN CERTIFICATE HELD — CERTIFICATE NUMBER

GRADE: PRIVATE, COMMERCIAL, AIRLINE TRANSPORT
RATINGS: ASEL, AMEL, ASES, AMES, HELICOPTER, GYROPLANE
TYPE RATING(S) (Specify)

7A. DO YOU HOLD A CURRENTLY EFFECTIVE CERTIFICATE OF WAIVER FOR CONDUCTING AGRICULTURAL AIRCRAFT OPERATIONS? — NO, YES (Complete 7B)

7B. WAIVER HELD — DATE ISSUED — EXPIRATION DATE — FAA DISTRICT OFFICE WHERE ISSUED

8. AGRICULTURAL AIRCRAFT TO BE OPERATED

MAKE	MODEL	EQUIPPED FOR: LIQUID	EQUIPPED FOR: SOLID	TOTAL NUMBER EACH AIRCRAFT OPERATED	REGISTRATION MARK (List a minimum of one)

9. LIST THE NAME(S) AND AIRMAN CERTIFICATE NUMBER(S) OF AGRICULTURAL PILOT(S) WORKING FOR YOU AT THE PRESENT TIME *(Use separate sheet and attach if additional space is needed.)*

NAME	CERT. NO.	NAME	CERT. NO.

10. REMARKS (If applicable)

11. CERTIFICATION: I CERTIFY THAT STATEMENTS MADE ON THIS FORM ARE TRUE AND CORRECT.

DATE — TITLE — SIGNATURE

FAA Form 8710-3 (12/16) SUPERSEDES PREVIOUS EDITION

Page 1

Agricultural Aircraft Operator Certificate

US Department of Transportation
Federal Aviation Administration

Operating Certificate

This certifies that

Spatial Data Analysis and Visualization Lab University of Hawaii at Hilo
200 W. Kawili Street
Hilo, HI 96722

has met the requirements of the Federal Aviation Act of 1958, as amended, and the rules, regulations, and standards prescribed therein, for the issuance of this certificate and is authorized to operate as an Air Operator and conduct

Commercial Agricultural Aircraft Operations

in accordance with said Act and its rules, regulations, and standards; Dispensing of Economic Poisons Allowed

This certificate is not transferable and, unless canceled, suspended, superseded, surrendered or revoked, shall continue in effect indefinitely

By Direction of the Administrator

On Behalf Of MERRITTE H WILSON II

Michael Heenan
(Signature)

Manager Honolulu FSDO
(Title)

Certificate number: LUHG777Q

Effective Date: April 6, 2023

Issued at: AFG-HNL-FSDO-WP13

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Who is on the list in Hawaii?

Air Operator Name	Part	Certificate Number	Principal City	Principal State
AIRBORNE AVIATION INC	137	3M3G282N	KILAUEA	HI
ALOHA AINA DRONE COMPANY LLC	137	3ZJG221S	HILO	HI
BIG ISLAND INVASIVE SPECIES COMMITTEE	137	7Y0G568R	HILO	HI
HAWAII AGRICULTURAL RESEARCH CENTER	137	70BG886Q	KAILUA	HI
K AND S HELICOPTERS INC	137	K2DG320J	KAILUA-KONA	HI
KONA DRONE SERVICE LLC	137	KDSG646Q	HOLUALOA	HI
MANUIWA AIRWAYS INC	137	DDWG150D	HILO	HI
MAUI INVASIVE SPECIES COMMITTEE	137	7XXG564R	PAIA	HI
NATIONAL TROPICAL BOTANICAL GARDEN	137	70DG887Q	KALAHEO	HI
NATIVE ECOSYSTEMS PROTECTION AND MANAGEMENT PROGRA	137	7W5G527R	KAHULUI	HI
PACIFIC HELICOPTER TOURS INC	137	DBZG128D	MAKAWAO	HI
THE SPATIAL DATA ANALYSIS & VISUALIZATION LAB, UNI	137	LUHG777Q	HILO	HI
WINDWARD AVIATION INC	137	WVXG810T	PUUNENE	HI

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Operational Documents You Need

- All Operations
  - Exemption Decision Letter and all Attachments
  - UAS & application equipment manuals/checklists
  - Product Labels and SDS
  - Worker Protection Standard Documents
  - Emergency Plan with Contact Phone Numbers
  - Application Record Sheet
- >55 lbs
  - Certificate of Authorization or Waiver (COA)
- Congested Area
  - Congested Area Plan
- Restricted Use Pesticides
  - Category 4 Aerial Pesticide Applicator License

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Remote Pilot Documents You Need

- Remote Pilot Certificate
- Re-currency Record
- Part 137 Endorsement
- Medical Certificate
- Government Issued Photo ID
- Category 4 Aerial Pesticide Applicator License

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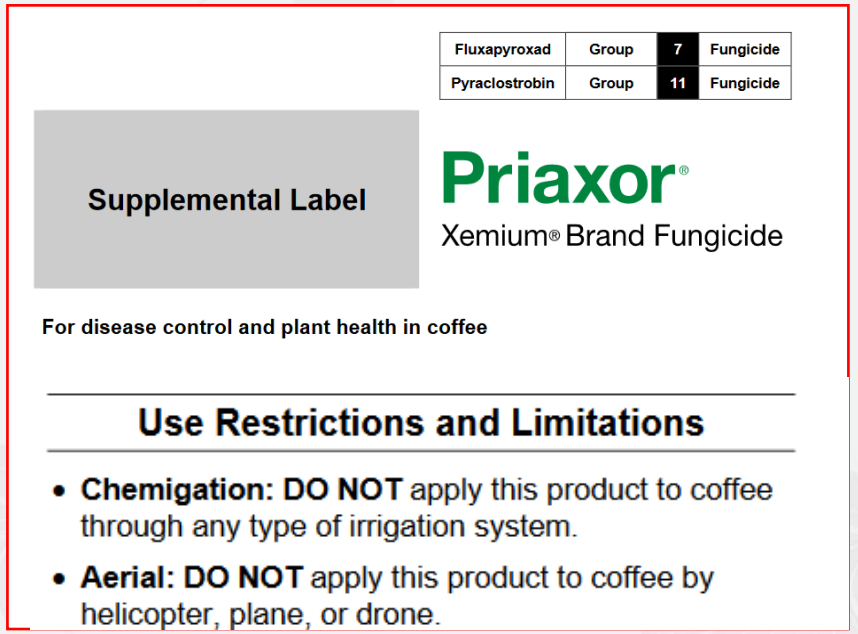
Check the Label

- The Label is the Law
- Is aerial application prohibited?
- Are there requirements for aerial equipment?
  - Required dilutions, nozzle angles, maximum application heights, etc.
- Application rate and droplet size
  - Some labels will give ranges or will lack specific recommendations



Fluxapyroxad	Group	7	Fungicide
Pyraclostrobin	Group	11	Fungicide

Supplemental Label

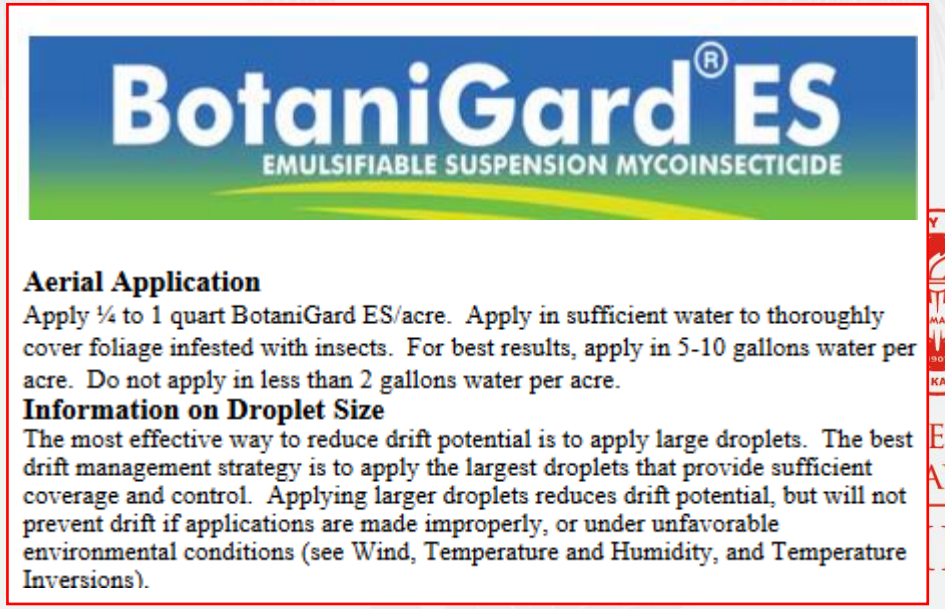
Priaxor®

Xemium® Brand Fungicide

For disease control and plant health in coffee

Use Restrictions and Limitations

- **Chemigation: DO NOT** apply this product to coffee through any type of irrigation system.
- **Aerial: DO NOT** apply this product to coffee by helicopter, plane, or drone.



BotaniGard® ES

EMULSIFIABLE SUSPENSION MYCOINSECTICIDE

Aerial Application

Apply ¼ to 1 quart BotaniGard ES/acre. Apply in sufficient water to thoroughly cover foliage infested with insects. For best results, apply in 5-10 gallons water per acre. Do not apply in less than 2 gallons water per acre.

Information on Droplet Size

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

Droplets – Label

syngenta

FIFRA

Section 18 Emergency Exemption

CYPERMETHRIN	GROUP	3A	INSECTICIDE

FOR USE ON ORNAMENTAL PALM CROWNS FOR CONTROL OF COCONUT RHINOCEROS BEETLE (*ORYCTES RHINOCEROS*) IN THE STATE OF HAWAII*

AERIAL APPLICATION RESTRICTIONS

- Do not release spray at a height greater than 10 feet above the vegetative canopy unless a greater application height is necessary for aircraft safety. Applicators are required to select nozzle and pressure that deliver medium or coarser droplets (ASABE S641).
- Do not apply when wind speeds exceed 15 mph at the application site.
- If the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When windspeed is between 11-15 miles per hour, applicators must use 3/4 swath displacement upwind at the downwind edge of the field.
- Do not apply during temperature inversions.

SPRAY DRIFT ADVISORIES

THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT. BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS.

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Droplets – Sizes

Droplet Size VMD Range	ASABE S-572.1 Classification Category	Color Code
Under 60	Extremely Fine (XF)	Purple
60-105	Very Fine (VF)	Red
106-235	Fine (F)	Orange
236-340	Medium (M)	Yellow
341-403	Coarse (C)	Blue
404-502	Very Coarse (VC)	Green
503-665	Extremely Coarse (XC)	White
Over 665	Ultra Coarse (UC)	Black

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Nozzle Tip

- Primary contributor to droplet size
- Color code indicates droplet size for specific conditions

- Need to check nozzle datasheet

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Nozzle Tip

	PSI	DROP SIZE 80°	DROP SIZE 110°	CAPACITY ONE NOZZLE IN GPM	CAPACITY ONE NOZZLE IN OZ./MIN.	20° GPA 4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH	GALLONS PER 1000 SQ. FT. 2 MPH	3 MPH	4 MPH	5 MPH
XR8001 XR11001 (100)	15	F	F	0.061	7.8	4.5	3.6	3.0	2.3	1.8	1.5	1.2	0.91	0.21	0.14	0.10	0.08
	20	F	F	0.071	9.1	5.3	4.2	3.5	2.6	2.1	1.8	1.4	1.1	0.24	0.16	0.12	0.10
	30	F	F	0.087	11	6.5	5.2	4.3	3.2	2.6	2.2	1.7	1.3	0.30	0.20	0.15	0.12
	40	F	F	0.10	13	7.4	5.9	5.0	3.7	3.0	2.5	2.0	1.5	0.34	0.23	0.17	0.14
	50	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
	60	F	VF	0.12	15	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
XR80015 XR110015 (100)	15	M	F	0.092	12	6.8	5.5	4.6	3.4	2.7	2.3	1.8	1.4	0.31	0.21	0.16	0.13
	20	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
	30	F	F	0.13	17	9.7	7.7	6.4	4.8	3.9	3.2	2.6	1.9	0.44	0.29	0.22	0.18
	40	F	F	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	50	F	F	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	60	F	F	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
XR8002 XR11002 (50)	15	M	M	0.12	15	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
	20	M	F	0.14	18	10.4	8.3	6.9	5.2	4.2	3.5	2.8	2.1	0.48	0.32	0.24	0.19
	30	F	F	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	40	F	F	0.20	26	14.9	11.9	9.9	7.4	5.9	5.0	4.0	3.0	0.68	0.45	0.34	0.27
	50	F	F	0.22	28	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	60	F	F	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
XR80025 XR110025 (50)	15	M	M	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	20	M	M	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
	30	F	F	0.22	28	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	40	F	F	0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	50	F	F	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	0.95	0.63	0.48	0.38
	60	F	F	0.31	40	23	18.4	15.3	11.5	9.2	7.7	6.1	4.6	1.1	0.70	0.53	0.42
XR8003 XR11003 (50)	15	M	M	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
	20	M	M	0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	30	F	F	0.26	33	19.3	15.4	12.9	9.7	7.7	6.4	5.1	3.9	0.88	0.59	0.44	0.35
	40	F	F	0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	50	F	F	0.34	44	25	20	16.8	12.6	10.1	8.4	6.7	5.0	1.2	0.77	0.58	0.46
	60	F	F	0.37	47	27	22	18.3	13.7	11.0	9.2	7.3	5.5	1.3	0.84	0.63	0.50

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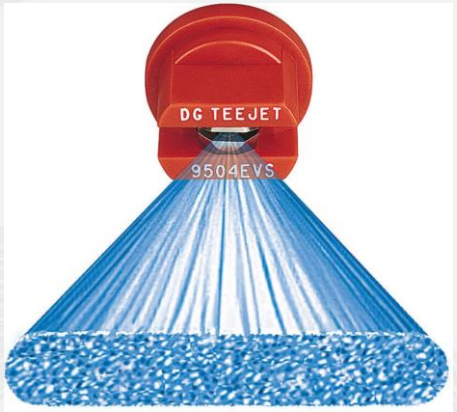
Other Nozzle Types

- Different nozzles yield different spray patters
- Flat fan nozzles provide high coverage in the center and less at the edges
  - XR nozzles
- Hollow cone and tapered edge flat spray nozzles provide more uniform coverage
- Solid stream nozzles apply large droplets directly below nozzle



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Nozzle Orifices

- Another means of adjusting flow
- Inserted below the tip

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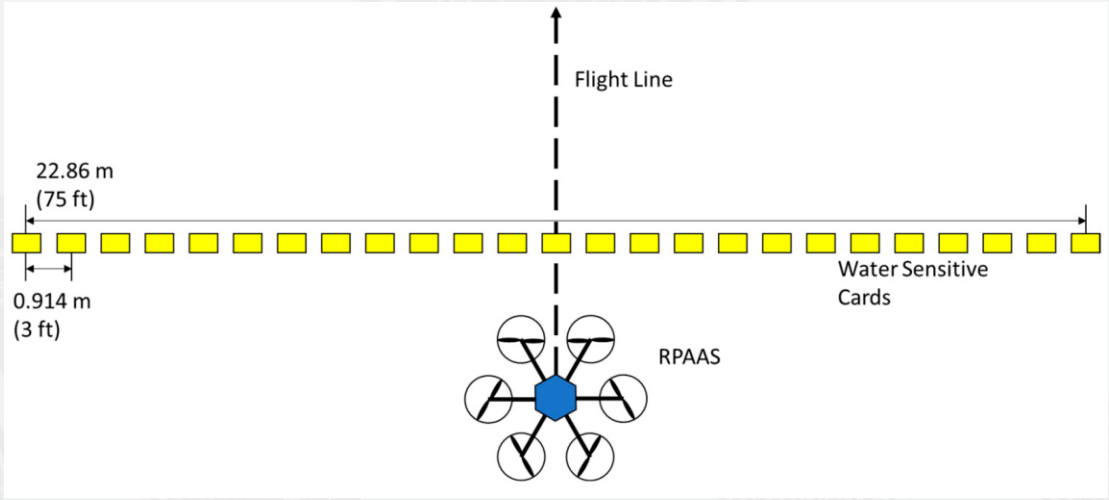
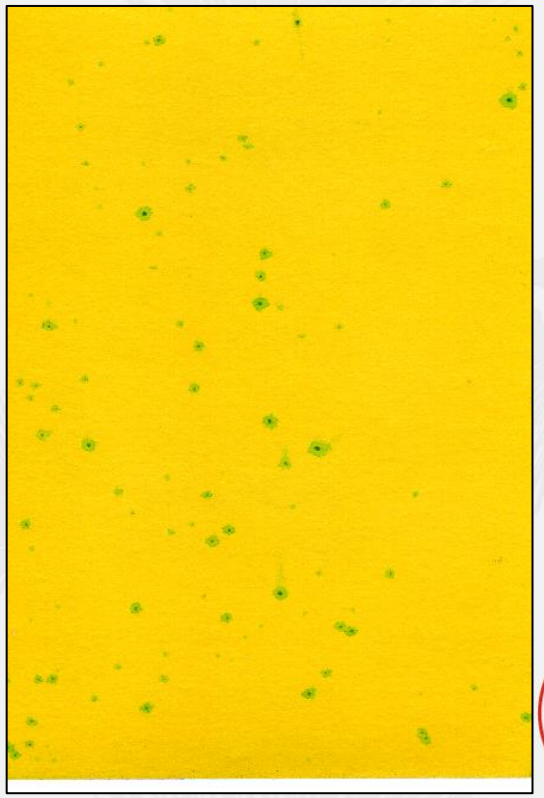
Checking the Swath and Droplet Spectra





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Checking the Swath and Droplet Spectra

Applicator	
	Roberto Rodriguez

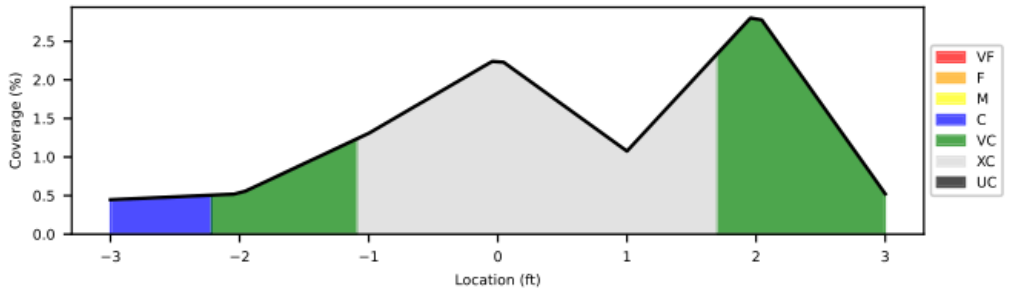
Aircraft	
Reg. #:	FA3MNNAEYW
Series:	1
Make:	DJI
Model:	Agras T10
Wingspan:	6 ft
Winglets?:	No

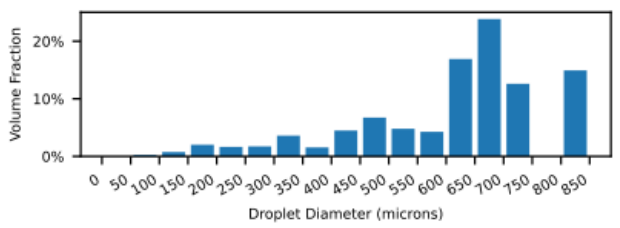
Spray System	
Target Swath:	4 ft
Target Rate:	
Boom Pressure:	30 psi
Boom Width:	60%
Boom Drop:	6 in
Nozzle Spacing:	43.20 in

Nozzles
Set #1
Teejet DG9505EVS @ 0°
Orif#150 x4
Set #2

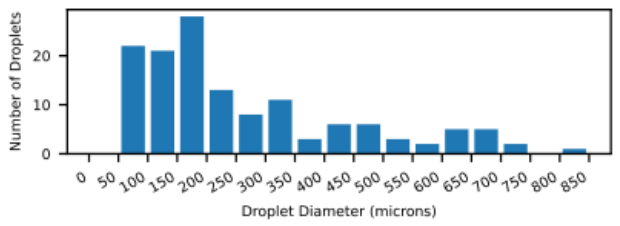
Observables	Pass 1	Average
Airspeed:	8	8 mph
Spray Height:	5	5 ft
Wind Speed:	3	3 mph
X-Wind Speed:	0.0	0.00 mph
Temperature:	85	85 °F
Humidity:	67	67%

Setup Notes

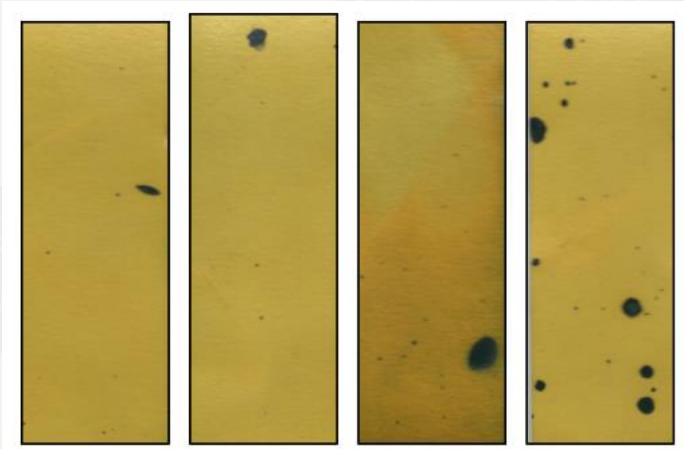




Composite - Pass 1	Measured [1,2]	USDA Model [3]
Category	XC	-
Dv0.1	313 µm	-
Dv0.5	621 µm	-
Dv0.9	711 µm	-
RS	0.64	-
Cov.	1.29%	
Area	16.09 in²	
Stains	136	
D / in2	8	



[1] Based on inputs, minimum detectable droplet diameter is 56 µm.
[2] Measured Droplet Spectrum Category is calculated with reference nozzle data, and should not be considered absolute.
[3] USDA Model flow-weighted and interpolated composite calculation based on stated nozzle configuration and quantities.



L3	
DSC	C
Dv0.1	186 µm
VMD	396 µm
Dv0.9	593 µm
RS	1.03
Cov.	0.45%
Area	2.32 in²
St.	24
St./in²	10

L2	
DSC	VC
Dv0.1	237 µm
VMD	438 µm
Dv0.9	640 µm
RS	0.92
Cov.	0.52%
Area	2.28 in²
St.	9
St./in²	4

L1	
DSC	XC
Dv0.1	256 µm
VMD	503 µm
Dv0.9	751 µm
RS	0.98
Cov.	1.31%
Area	2.32 in²
St.	6
St./in²	3

Center	
DSC	XC
Dv0.1	393 µm
VMD	628 µm
Dv0.9	710 µm
RS	0.50
Cov.	2.28%
Area	2.32 in²
St.	17
St./in²	7

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Rotary Atomizers

- Uses a spinning disc to generate droplets of specific size
- Size is based on RPM of nozzle
- Allows for use of one nozzle for multiple droplet sizes rather than needing multiple

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DJI T20P Test

- Formulation: Water
- Application Rate: 5 gal/acre
- Altitude: 8 ft
- Groundspeed: 5 m/s
- Droplet size setting:
  - Medium
  - Coarse

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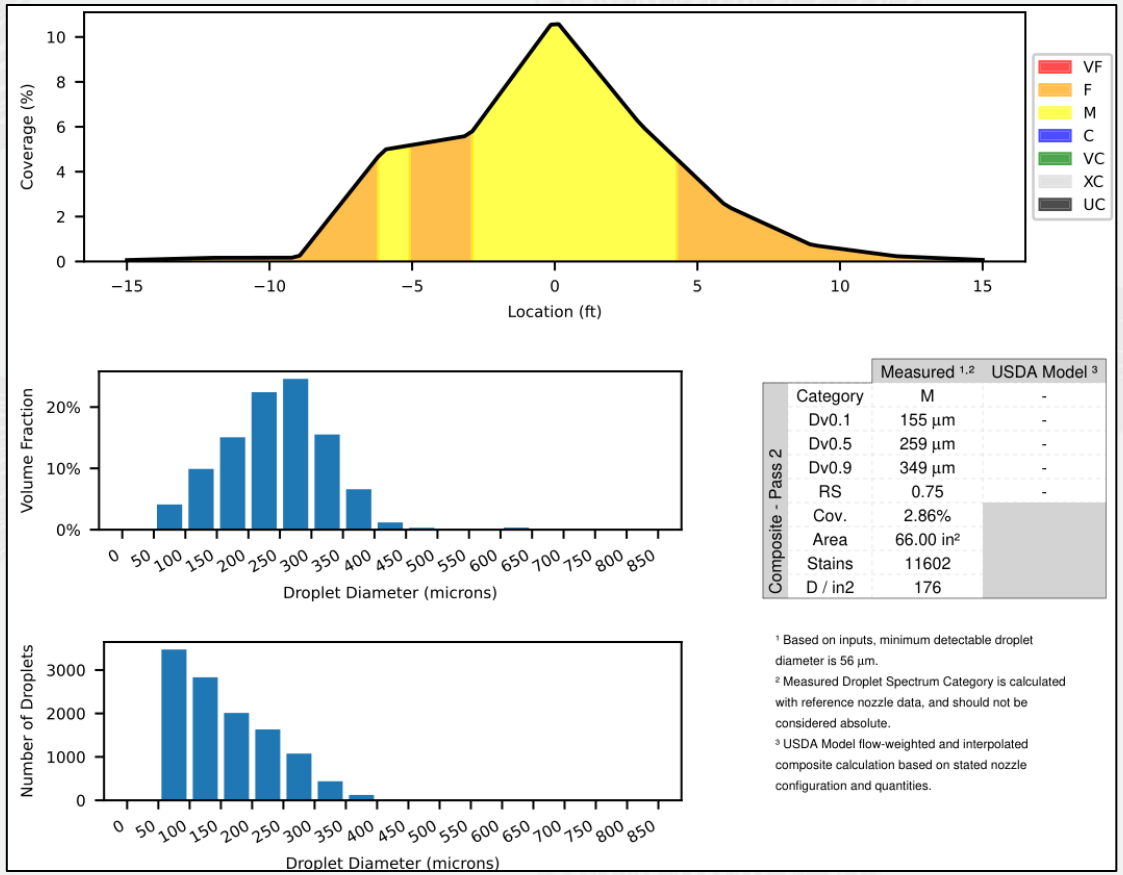
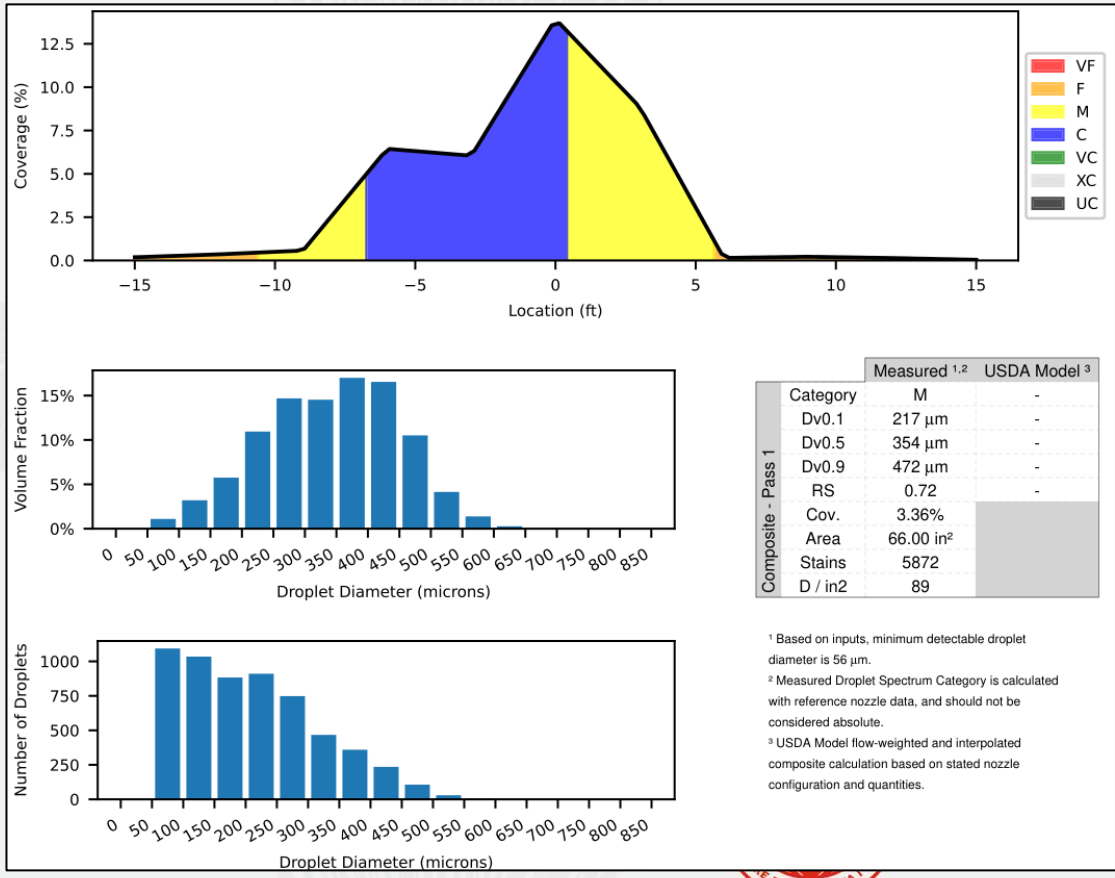
Rotary Atomizer



Composite - Pass 2	Measured [1,2]	USDA Model [3]
Category	M	-
Dv0.1	155 µm	-
Dv0.5	259 µm	-
Dv0.9	349 µm	-
RS	0.75	-
Cov.	2.86%	
Area	66.00 in²	
Stains	11602	
D / in2	176	

[1] Based on inputs, minimum detectable droplet diameter is 56 µm.
[2] Measured Droplet Spectrum Category is calculated with reference nozzle data, and should not be considered absolute.
[3] USDA Model flow-weighted and interpolated composite calculation based on stated nozzle configuration and quantities.



Composite - Pass 1	Measured [1,2]	USDA Model [3]
Category	M	-
Dv0.1	217 µm	-
Dv0.5	354 µm	-
Dv0.9	472 µm	-
RS	0.72	-
Cov.	3.36%	
Area	66.00 in²	
Stains	5872	
D / in2	89	

[1] Based on inputs, minimum detectable droplet diameter is 56 µm.
[2] Measured Droplet Spectrum Category is calculated with reference nozzle data, and should not be considered absolute.
[3] USDA Model flow-weighted and interpolated composite calculation based on stated nozzle configuration and quantities.

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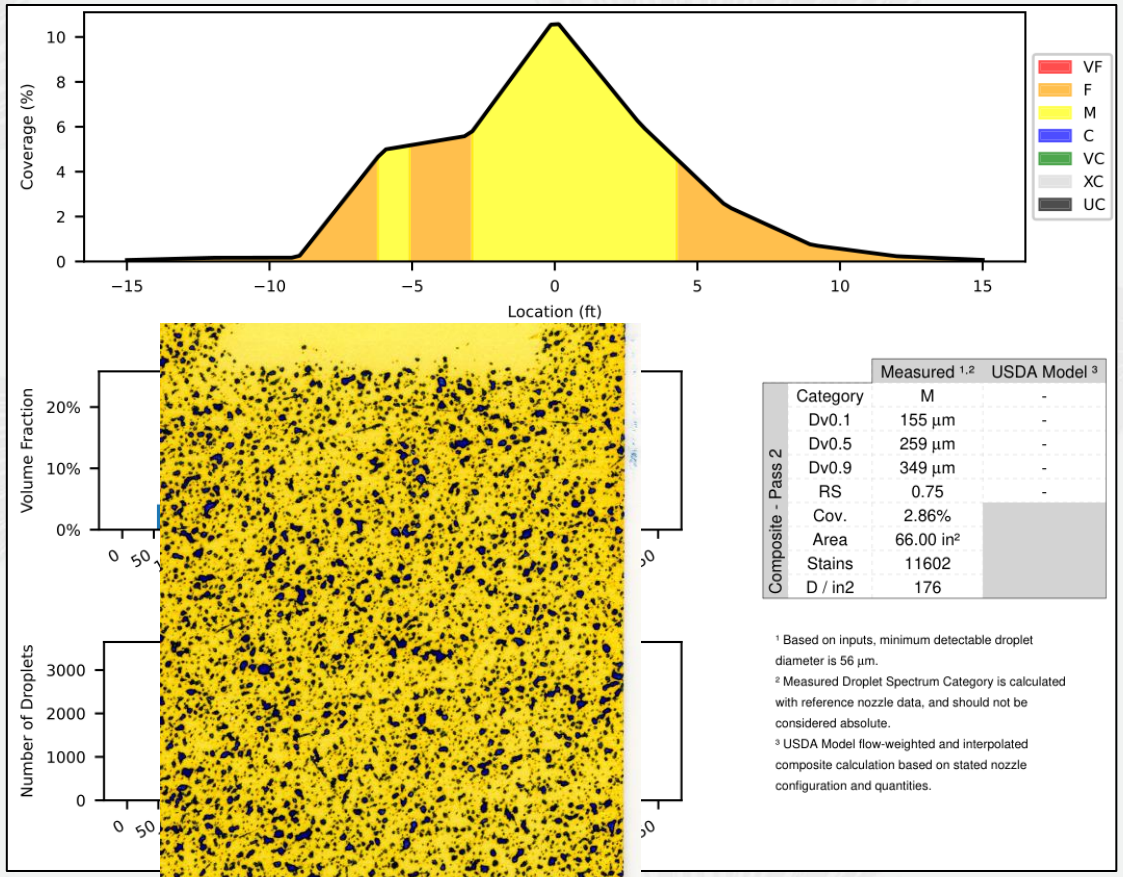
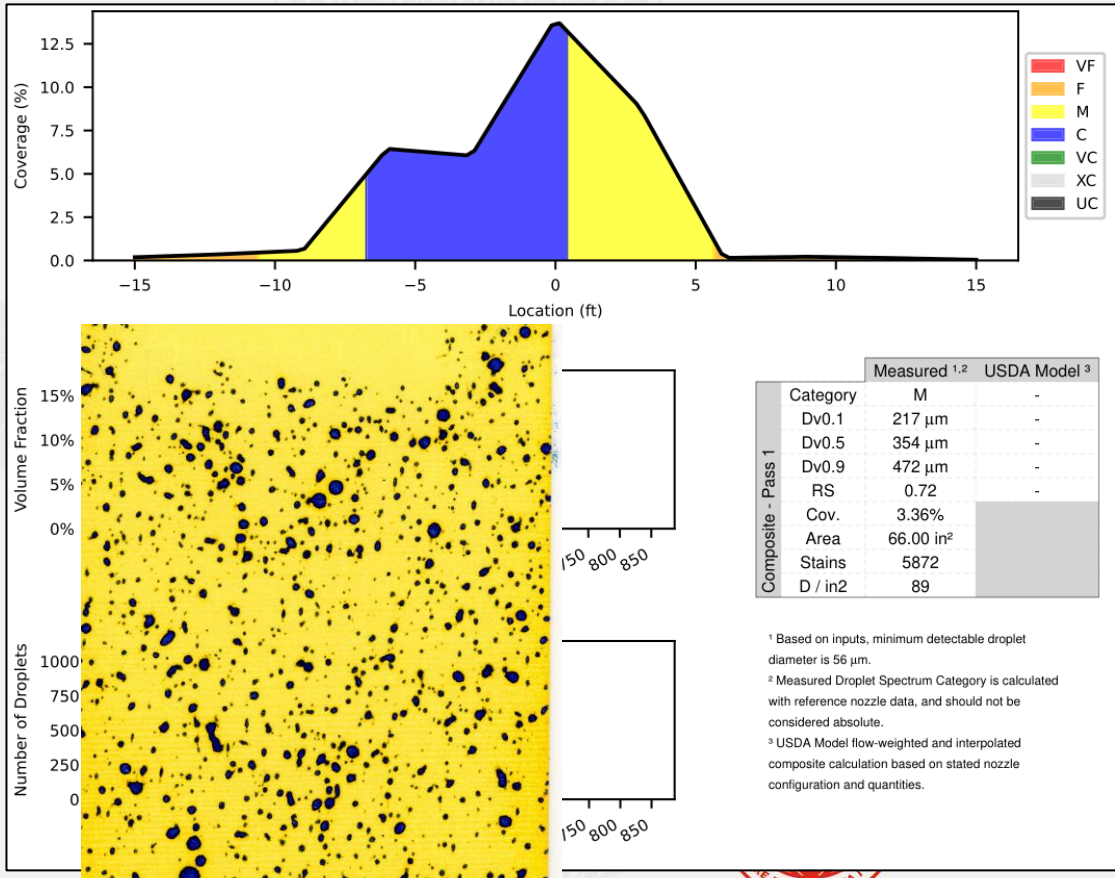
Rotary Atomizer





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Acknowledgements

- Mahalo
  - Aloha Aina Drone Company
  - Keau RC Field
  - CAFNRM

Agricultural Aircraft Operations Regulations and Exemptions

Big Island Weed Management & Restoration Forum

Roberto Rodriguez III
Aeronautical Sciences Department
University of Hawai‘i at Hilo

10/23/2024