

Unmanned
Aircraft



SYSTEMS

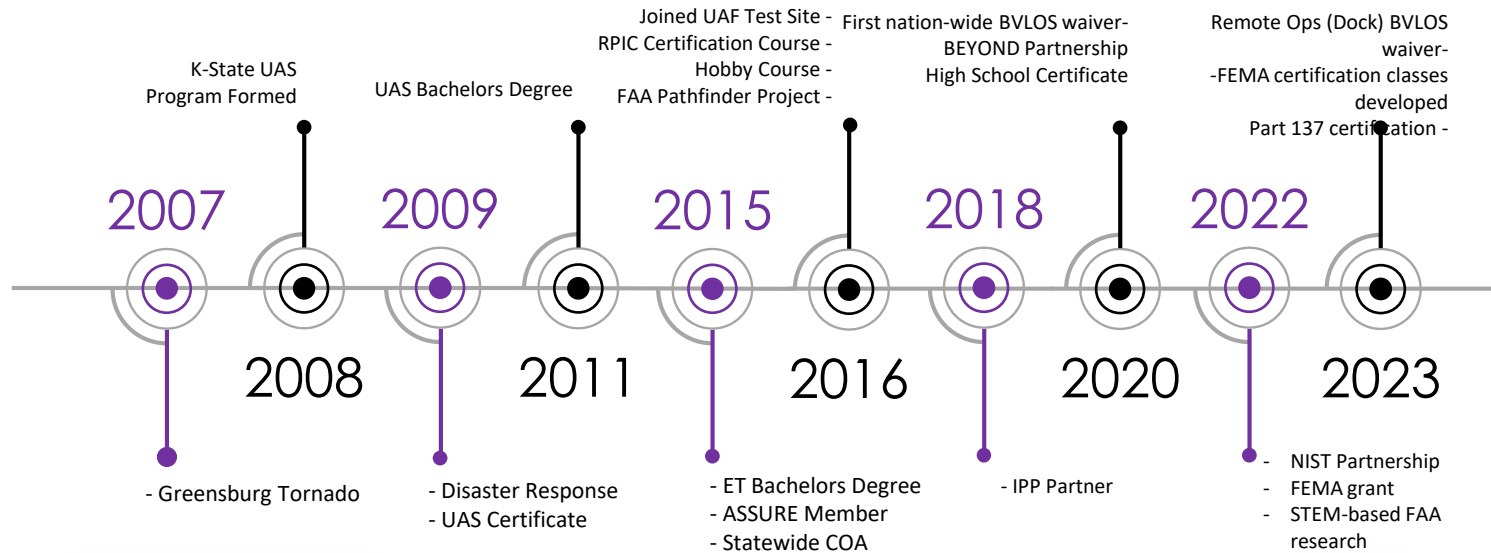
State of the Industry: Drones

Spencer Schrader
UAS Flight Operations Manager

KANSAS STATE

UNIVERSITY

History of K-State UAS



K-State UAS Pillars

K-State Salina Aerospace and Technology

Research

Flight Ops & Training

Maintenance/Technology

Academics

Applied Aviation Research Center

Faculty

UAS Program

KANSAS STATE
Unmanned Aircraft Systems

Training Short Courses (non-credit)

- Commercial sUAS Training (Part 107): 3 days
- Basic Multi-rotor sUAS Training: ½ day
- Advanced Multi-rotor sUAS Training:
Customized (2-5 days)
- Law Enforcement sUAS Training: Customized (1-3 days)
- Fire and HAZMAT sUAS Training: Customized (1-3 days)
- Multi-rotor Night Training: ½ “day”
- Fixed-wing sUAS Training: 10 days
- Data Processing Training: 3 days

For more information: www.salina.k-state.edu

Intro to UAS Technology Certificate

- **Workforce Development Courses—14 credit hours (13 of 14 online)**
 - FAA Remote Pilot in Command Certificate
 - Multi-rotor Flight lab
 - Intro to UAS
 - UAS Safety Fundamentals
 - Small UAS Maintenance
 - Multi-rotor Design & Construction Lab
- **Pre-college tuition: \$122/credit hour plus lab fees**

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UAS Types and Applications

Types of UAS/Drones

Multicopter aircraft

- Vertical takeoff and land
- Confined spaces
- Hover like a helicopter
- Average flight time of 30 minutes



Types of UAS/Drones

- **Fixed-wing aircraft**
 - Requires large area for takeoff/land
 - Faster than multirotor aircraft
 - Longer endurance (1 to 24 hours)
 - Cover large areas



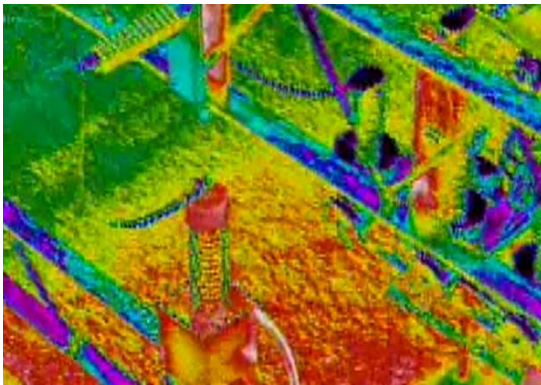
Types of UAS/Drones

- **Hybrid aircraft-**
 - Combination of fixed-wing and multirotor aircraft
 - Best of both worlds
 - Vertical takeoff/land
 - Best for confined spaces
 - Long endurance



Energy Applications

Electrical Inspections



Line Pulling & Inspections

Wind Turbine Inspections



First Responder Applications

Fire Response



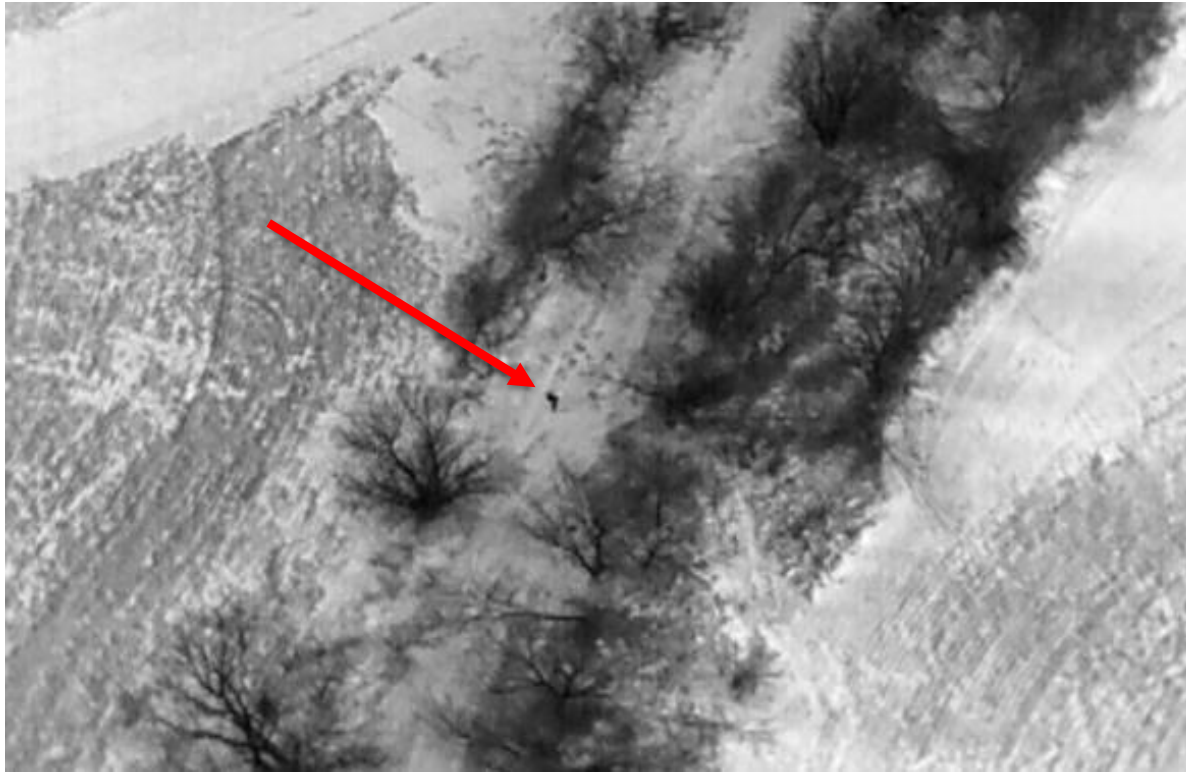
Natural Disaster Response



First Responder Applications



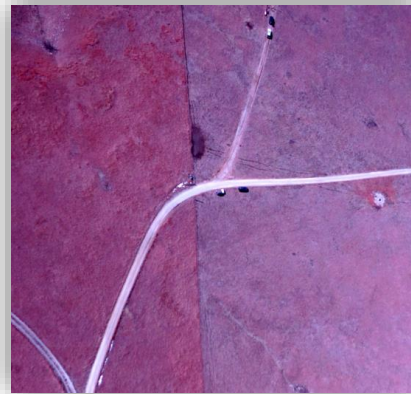
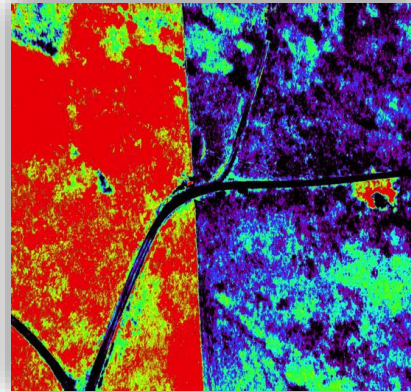
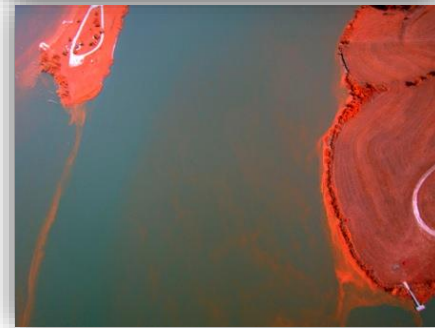
Search and Rescue



Can you find the person?

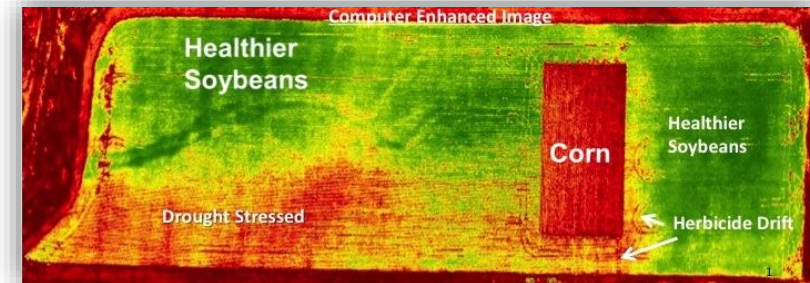
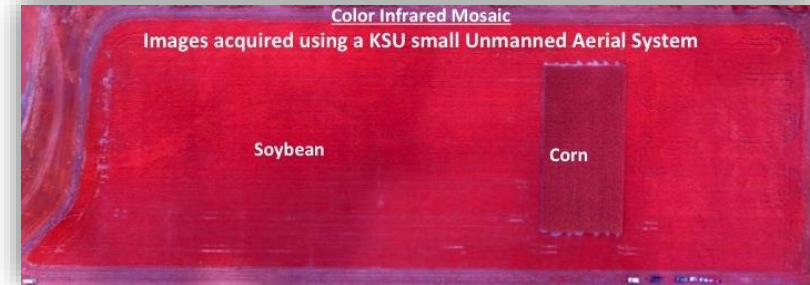
Mapping/Agriculture

Algal Bloom Monitoring



Rangeland Assessment

Crop Health



Agriculture

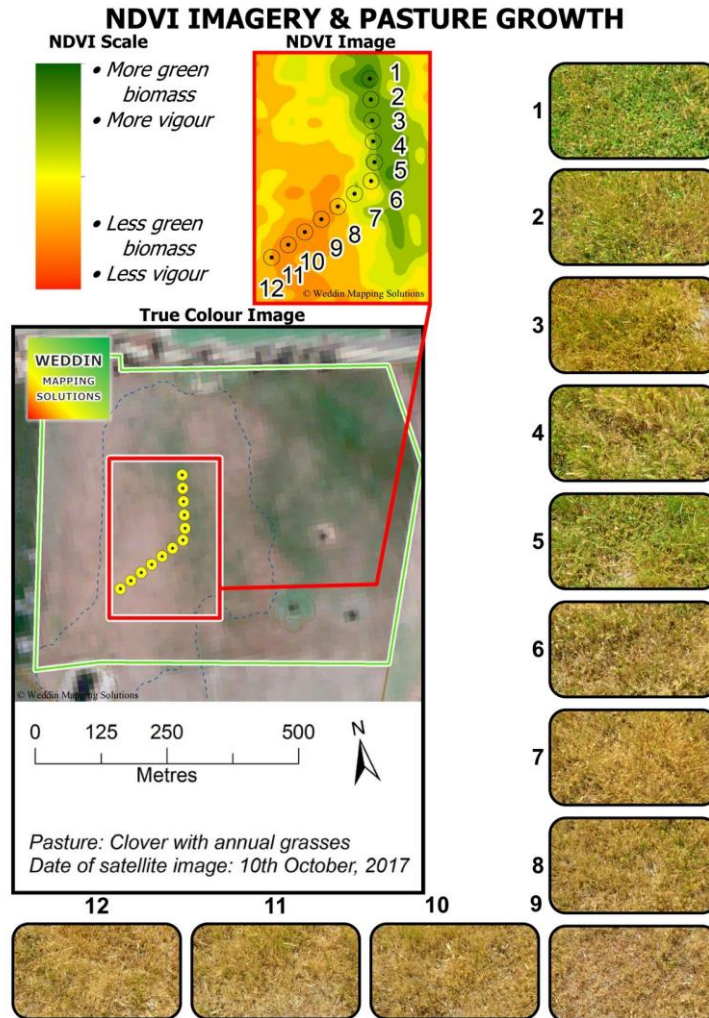


Photo courtesy of Weddin Mapping Solutions

Agriculture

- Terrace design
- Insurance claims
- Normalized Digital Vegetation Index (NDVI)
 - Helps determine what areas are stressed from disease or drought
- Stand counts (germination rate)
- Aerial application
 - More precise than manned aircraft
 - Less concern over drift
 - Access areas that conventional methods can't
 - Better coverage than conventional methods in many cases
 - Safer than conventional aerial application methods
 - Will **not** replace conventional spraying methods anytime soon



Future Applications

- Wide-spread package delivery (ongoing)
- Medical deliveries (ongoing)
- Uber/Lyft (AAM)
- Autonomous inspections (R&D)
- List goes on and on!



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UAS Regulatory Environment

Commercial vs Recreational

- **Two main options when operating a drone:**
 - **Commercially**
 - Drone is used for business purposes in or your line of work
 - Realtor, inspection work, farming/ranching, etc.
 - **Recreationally**
 - Drone is used for fun, for personal enjoyment
 - Taking scenic photos, filming yourself riding a bike, etc.

14 CFR Part 107- Small Unmanned Aircraft Systems Commercial Regulations

- Released in August of 2016
- Regulates drones used for commercial purposes
- “Small” is defined as less than 55 pounds
- Requires an FAA certificate for operations, similar to PPL
- Must be 16 years or older to obtain the certificate
 - Remote Pilot in Command (RPIC) certificate



Part 107 Overview

- RPIC certificate can be obtained by 2 methods-
 - Passing an aeronautical knowledge test
 - Certificate is received within 1-2 weeks
 - Current Part 61 pilots take a training course
- Recurrent training every 2 years
- 400' above ground level maximum altitude
- Maximum groundspeed of 100mph
- Visual line of sight only
- Airspace restrictions
- No carriage of hazardous materials*

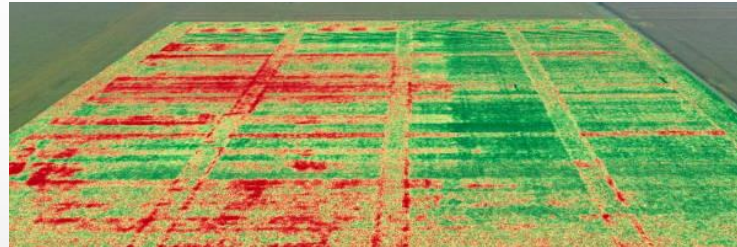


How to Become a Part 107 Operator

1. Must be able to read, write, speak, and understand the English language.
2. Be at least 16 years of age
3. Pass an initial 60-question certification test with a 70% or better*
4. Pass a background check
5. Complete a currency test every 24 calendar months

Operations Under Part 107

- Public Safety
 - Firefighting
 - Search and Rescue
 - Law Enforcement
 - Natural Disaster Response
- Aerial Photography
- Inspections
 - Utility
 - DOT
- Conservation
 - Population Counts
- Surveying
- Agriculture
 - Rangeland Assessment
 - Crop Health
 - Terrace Design
 - Damage Assessment
 - Stand Counts
 - **Chemical application?**



49 U.S.C. §44807:

Special Authority for Certain Unmanned Aircraft Systems

- “Section 44807 Exemption”
- Risk-based approach on a case-by-case basis
- Allows aircraft 55 pounds and larger to operate in the National Airspace System (NAS)
- The operator must possess a Part 107 RPIC certificate
- Required for carriage of hazardous material



Section 44807 Overview

- To obtain an exemption, the operator must file a petition including-
 - Concept of Operations
 - Operations Manual
 - Emergency Procedures
 - Checklists
 - Maintenance Manual
 - Training Program
 - Flight History
 - Safety Risk Analysis
- Operator must maintain at least a current FAA third-class airman medical certificate
- Takes 4-6 months for approval
- Valid for 2 years
- Operate in accordance with a Certificate of Authorization (COA)
- Typical COA limitations-
 - 400' maximum altitude
 - Visual line of sight
 - Maintain at least 500' separation from non-participating persons, and from vehicles and structures
 - Distance from airport limitation
 - Publish a Notice to Air Mission (NOTAM) at least 24 hours in advance of an operation
 - Report flights monthly to the FAA

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION	
CERTIFICATE OF WAIVER OR AUTHORIZATION	
ISSUED TO	Any Operator with a valid 49 USC 44807 Grant of Exemption
This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.	
OPERATIONS AUTHORIZED	Operation of Unmanned Aircraft System(s) (UAS) in accordance with the operators' 49 USC 44807

Carriage vs Dispensing

- 44807 Exemptions allow for the *carriage* of hazardous materials (herbicide, pesticide)
- Part 137- “Agricultural Aircraft Operations”, allows for the *dispensing* of those chemicals, or “economic poisons”
- Economic poisons definition- “(1) Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, weeds, and other forms of plant or animal life or viruses, except viruses on or in living man or other animals, which the Secretary of Agriculture shall declare to be a pest, and (2) any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant.”



Operational Comparisons

Condition	Part 107	Section 44807 Exemption Blanket COA
Distance	VLOS only by RPIC	VLOS only by RPIC and VO
Altitude	400 feet AGL	400 feet AGL
Speed	87 knots	87 knots
Registration	Required through Part 48 or Part 47	Required through Part 47
Payloads	Standard Payloads. Carriage of hazardous materials are prohibited	Standard Payloads. Carriage of hazardous materials are permitted
Dispensing Hazardous Chemicals	Prohibited	Permitted if operator holds a Part 137 Certificate
Airworthiness	Self-certify (preflight inspection)	Self-certify (preflight inspection)
Weather Minimums	500' below clouds, 2000' horizontal & 3 SM miles vis	500' below clouds, 2000' horizontal & 3 SM miles vis
Reporting	No reporting required unless an accident occurs	Monthly reporting required and all accidents
Visual Observer	Not Required	Required
Operating area	Class G (waivers or authorizations available through directly through the FAA or LAANC)	<ul style="list-style-type: none"> - Class G (specific airspace authorizations available) <ul style="list-style-type: none"> - 5 NM away from an airport with a tower - 3 NM from an airport with instrument approach but no control tower - 2 NM from non instrument or towered airport <ul style="list-style-type: none"> - 2 NM away from heliport
Pilot Certification	FAA Certification	FAA Certification
Operational Times	Day or night	Day or night
Operational Boundaries	Not directly over people unless within one of four categories	500' from all nonparticipating persons, vessels, vehicles, and structures

K-State's Path to Aerial Applicating

1. Identify the aircraft

1. DJI Agras platform
2. Yamaha FAZER R G2
3. Hylío platform



2. The size of the platform determines the regulatory pathway

1. Part 107 covers small UAS < 55 pounds
2. *Section 44807 Exemption* for aircraft 55 pounds or larger

Aircraft Selection

- Through partnership with KDOT, K-State procured the Hylío AG-272
- Manufactured in Texas, NDAA-compliant
- 18-gallon capacity; spreader attachment
- 400-pound MTOW
- 50 acres/hour
- Excellent customer support



Section 44807 Exemption Application

- **Applications/Decisions can be found on Regulations.gov**
- **Application requires the following-**
 - Concept of Operations
 - Operations Manual
 - Emergency Procedures
 - Checklists
 - Maintenance Manual
 - Training Program
 - Flight History
 - Safety Risk Analysis
- **Once approved, operations must be conducted in accordance with the assigned COA**

Other FAA Regulations

- Part 137 governs the use of aircraft, including drones, to dispense or spray substances

§ 137.3 Definition of terms.

For the purposes of this part—

Agricultural aircraft operation means the operation of an aircraft for the purpose of

- (1) dispensing any economic poison,
- (2) dispensing any other substance intended for plant nourishment, soil treatment, propagation of plant life, or pest control, or
- (3) engaging in dispensing activities directly affecting agriculture, horticulture, or forest preservation, but not including the dispensing of live insects.

Economic poison means

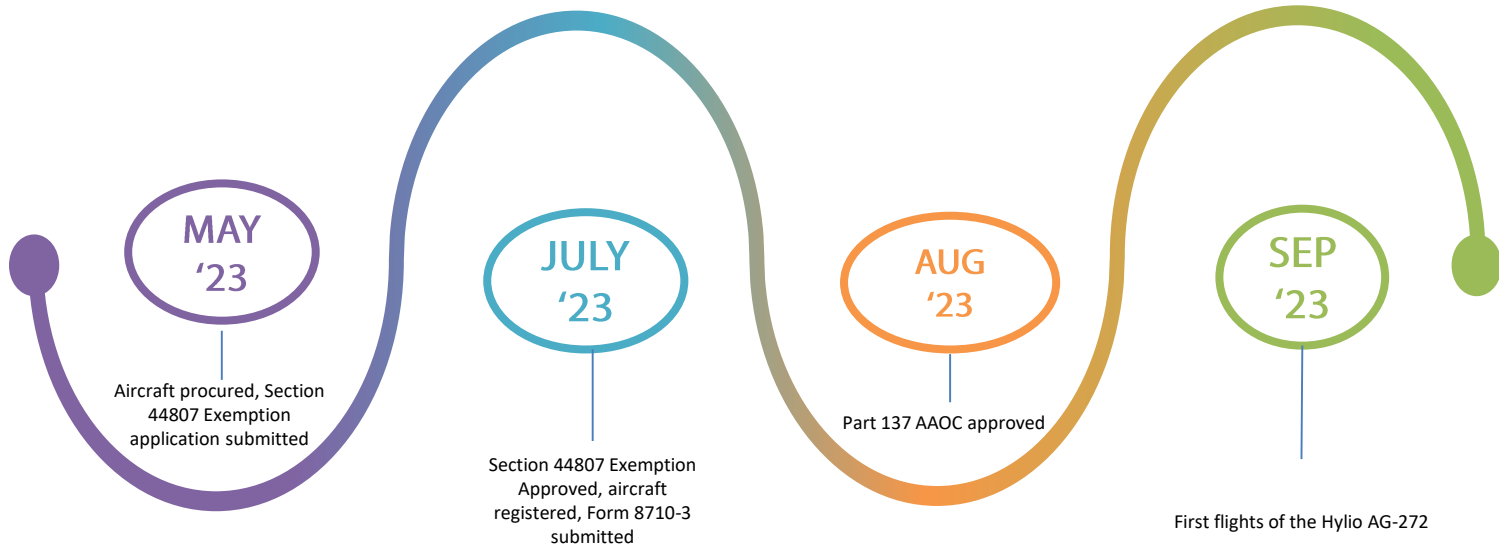
- (1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, weeds, and other forms of plant or animal life or viruses, except viruses on or in living man or other animals, which the Secretary of Agriculture shall declare to be a pest, and
- (2) any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant.

Part 137 Agricultural Aircraft Operator's Certificate

- Operator must complete FAA Form 8710-3
- Send to UAS137Certificates@faa.gov
- Must submit after Section 44807 Exemption has been approved

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				FOR DISPENSING (Check one)							
		PRIVATE				ECONOMIC POISONS							
		COMMERCIAL				OTHER THAN ECONOMIC POISONS							
						ORIGINAL							
						AMENDMENT							
						REISSUANCE							
2. NAME AND ADDRESS OF APPLICANT						3. PRINCIPAL OPERATIONS BASE (Airport, City, State)							
TELEPHONE NUMBER						TELEPHONE NUMBER							
4. OPERATING AS		INDIVIDUAL		OTHER (Specify)				5. NAME OF CHIEF SUPERVISOR OF OPERATIONS (Commercial Operations Only)					
		CORPORATION											
		PARTNERSHIP											
								(First)		(Middle Initial)		(Last)	
6. AIRMAN CERTIFICATE HELD						CERTIFICATE NUMBER							
GRADE						RATINGS							
PRIVATE		ASEL		AMES		TYPE RATING(S) (Specify)							
COMMERCIAL		AMEL		HELICOPTER									
AIRLINE TRANSPORT		ASES		GYROPLANE									
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							

Timeline



Additional Considerations

- **State laws governing the application of chemical**
 - Applicator/Business License
- **Transport of equipment**
 - Trailer with tanks, pumps, generator
- **COA limitations**
 - The blanket COA is severely limited



Questions?

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