

Regulatory Requirements to Operate Spraying Drones¹

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Spraying drones, also known as spraying unmanned aerial systems (UAS) or unmanned aerial vehicles (UAV), represent a cutting-edge technology revolutionizing modern farming practices. These drones (Figure 1) are designed to spray on crops efficiently and precisely. By leveraging advanced GPS technology and onboard sensors, spraying drones ensure targeted application, reducing chemical wastage and minimizing environmental impact (Canicatti and Vallone 2024; Rejeb et al. 2022). Their ability to quickly cover large areas, including rugged terrains, significantly enhances agricultural productivity and sustainability (Taseer and Han 2024). As a result, spraying drones are becoming an effective tool in precision agriculture.

This article aims to present and discuss regulatory requirements for UAS for agricultural spraying applications to students, research scientists, Extension agents, growers and allied industry, consulting companies, and state agency personnel. It explores the FAA regulations and presents the application procedure to receive a license to operate spraying drones. It includes the basic FAA regulations about drone control and management, how to obtain a Part 107 license, advanced rules about Section 44807 exemption to operate a heavy-payload UAS, and the procedure of FAA Part 137 for agricultural aircraft operator certification.



Figure 1. Commercial spraying drone on a watermelon field.
Credits: W. Liu, UF/IFAS

1. FAA UAS Control and Management Policy

The Federal Aviation Administration (FAA) has established a comprehensive policy framework for the control and management of all types of UAS, emphasizing safety, security, and effectiveness in the national airspace. Key aspects include mandatory registration for UAS over 0.55 pounds, operational guidelines under Part 107 for commercial UAS, and strict visibility requirements. The FAA uses tools like the Low Altitude Authorization and Notification Capability (LAANC) for controlled airspace access and is developing a UAS Traffic Management (UTM) system to support advanced operations such as beyond visual line of sight flights. Regular updates to these policies ensure they remain responsive to technological advancements and operational needs in UAS deployment.

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The FAA has developed several specific regulations to govern the operation of UAS within the United States. The following are vital regulations and initiatives related to spraying drones under the FAA's broader UAS policy framework:

- **Part 107 (Small Unmanned Aircraft Systems).** This is the primary set of rules for commercially operating small UAS (under 55 pounds). It outlines requirements for pilot certification, operational limits, and waivers for expanded operations.
- **Section 44807 Exemption.** It allows the FAA to grant exemptions for operating UAS weighing more than 55 pounds. Operators must submit a detailed application demonstrating that their operations can be conducted safely. If granted, the exemption includes specific conditions and limitations. This provision facilitates the integration of larger UAS into the national airspace for various commercial applications, such as agriculture and infrastructure inspections.
- **Part 137 (Agricultural Aircraft Operations).** This primarily governs aerial application activities like crop dusting, seeding, and spraying. UAS can potentially be used under this regulation as technology in agricultural UAS advances.

Figure 2 outlines the entire legal application process for spraying drones and provides an overview of the article's structure.

2. Basic Regulation — Part 107 License

2.1 What is Part 107?

FAA Part 107 governs the commercial use of small UAS weighing under 55 pounds. It requires operators to obtain a Remote Pilot Certificate by passing an aeronautical knowledge test. Key operational stipulations under Part 107 include flying within visual line of sight, during daylight or twilight with appropriate lighting, and not directly over people unless involved in the operation. UAS flights in controlled airspace require authorization through the Low Altitude Authorization and Notification Capability (LAANC) system or similar FAA processes. For operations outside these standard guidelines, operators can apply for specific waivers, demonstrating safe conduct under proposed conditions. Part 107 aims to integrate commercial UAS safely into the national airspace, supporting economic growth and technological innovation.

2.2 How to Apply for a Part 107 License

Figure 3 provides an overview of the procedures for applying for and obtaining a Part 107 license.

a) Check Eligible Condition

The first step before all procedures is to check eligibility for a Remote Pilot Certificate. To be eligible, the individual must be: 1) at least 16 years old; 2) able to read, write, speak, and understand English; and 3) in a physical and mental condition to safely fly a UAS.

b) Study for the Knowledge Test

Review suggested study materials for the knowledge test. The official study guideline, the *Knowledge Test Study Guide*, was issued by the FAA with ID FAA-G-8082-22 in August 2016. It includes related regulations, airspace, weather, emergency procedures, radio communication, aircraft performance, etc. It can be downloaded at https://www.faa.gov/sites/faa.gov/files/regulations_policies/handbooks_manuals/aviation/remote_pilot_study_guide.pdf. FAA also offers more study materials about aeronautical knowledge, like *Pilot's Handbook of Aeronautical Knowledge* with ID FAA-H-8083-25C, which offers more detailed information. It can be downloaded at https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak. Additionally, the FAA offers practice exams at the PSI Services Knowledge Testing Centers (<https://faa.psiexams.com/FAA/login>).

c) Obtain an FAA Tracking Number (FTN)

Create an Integrated Airman Certification and Rating Application (IACRA) profile at <https://iacra.faa.gov/IACRA/>. Record the FTN on the profile page.

d) Take Knowledge Test

Schedule and take the knowledge test at an FAA-approved knowledge testing center. They are usually located in airports or flight schools. All exam schedules and related information can be found at <https://faa.psiexams.com/faa/login>. The duration of the test spans 150 minutes. Once the test concludes, a paper report containing the FTN will be printed. A final score over 70% is a passing score.

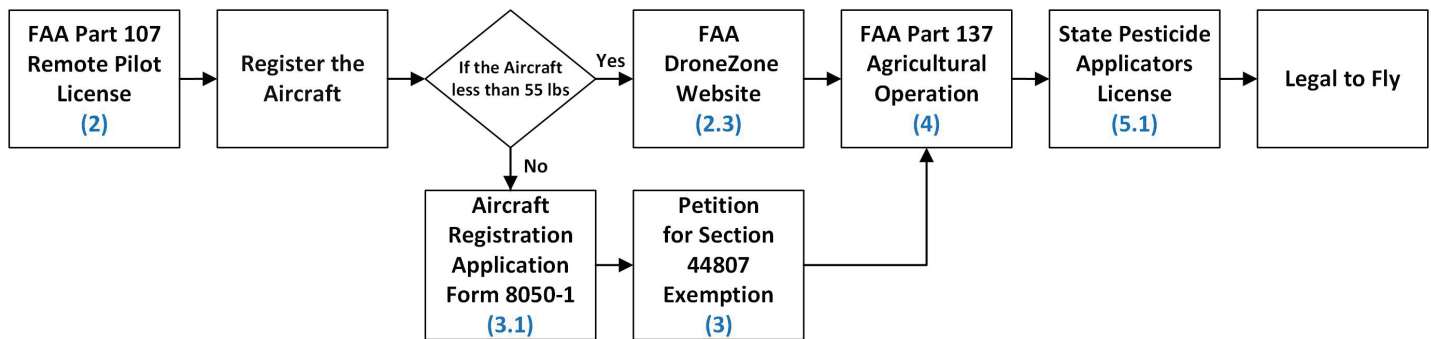


Figure 2. Procedures for receiving a license to operate spraying drones. The numbers in parentheses represent the sections where each topic is discussed in this publication.

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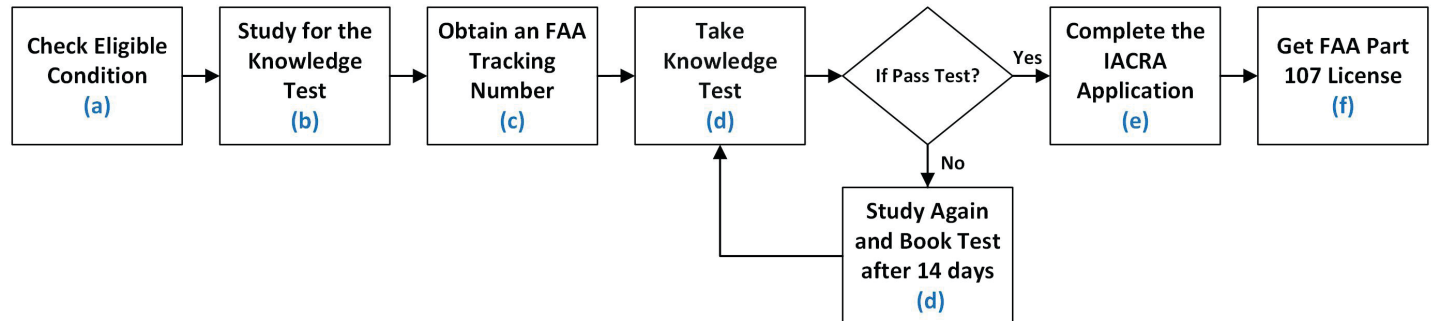


Figure 3. Procedures for obtaining an FAA Part 107 license. The letters in parentheses represent the steps listed below.

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e) Complete the Application

After you have passed the knowledge test, go back to IACRA to complete the final application. Start a new application as “Pilot,” select “Remote Pilot — Initial” in the certificate, and select “Small Unmanned Aircraft System” in the certificate class. Then, review and submit all personal information, supplementary data, and the basis of issuance. Finally, the application must be reviewed and submitted using FAA Form 8710-13.

f) Get License

An email confirmation will be sent when the applicant has completed the TSA security background check. This email will contain guidance on how to obtain a temporary Remote Pilot Certificate from IACRA. Subsequently, a permanent Remote Pilot Certificate will be mailed once all internal FAA processing is finalized.

2.3 UAS Registration (for UAS under 55 pounds)

Registering a UAS under 55 pounds requires providing contact information and the UAS’s make and model at the FAA DroneZone website. A fee of \$5 will be charged for three years of validation. Registrants must adhere to age, citizenship, or residency qualifications. The UAS must

display its registration number, and the operator is required to carry the registration certificate while flying. More detailed instructions can be found on the FAA’s How to Register Your Drone page: <https://faadronezone-access.faa.gov/>.

Additionally, starting September 16, 2023, UAS needing an FAA registration number must also broadcast Remote ID information unless they are operated within a FRIA (https://www.faa.gov/uas/getting_started/remote_id/fria).

3. Additional Regulation for UAS over 55 pounds — Special Airworthiness Certificate or Section 44807 Exemption

FAA Part 107 serves as a critical regulation for commercial UAS flights in the U.S., yet it does not cover every scenario. This part explores one of the significant exceptions to Part 107: the operation of UAS weighing more than 55 pounds. To operate UAS over 55 pounds, operators need to apply for either an exemption under a Special Airworthiness Certificate or a Section 44807 exemption.

3.1 UAS Registration (for UAS over 55 pounds)

To register a UAS over 55 pounds using the Traditional Aircraft Registration process, complete the Aircraft Registration Application (AC Form 8050-1, <https://www.faa.gov/forms/index.cfm/go/document.information/documentid/185220>) and provide a notarized affidavit with the UAS's specifications and ownership details. A reserved N-number is required if applicable. Include a \$5 fee payable to FAA. Mail all documents to the FAA's Aircraft Registration Branch. Further guidance can be found on the FAA's Aircraft Registration page: https://www.faa.gov/licenses_certificates/aircraft_certification/aircraft_registry/ua.

3.2 Special Airworthiness Certificate

A Special Airworthiness Certificate (SAC) is an FAA authorization that enables aircraft, including UAS, to operate in specific categories beyond standard regulations for various purposes, such as relocating an aircraft for repairs or storage, conducting flight tests, or when a UAS exceeds typical operational limitations. This certificate is crucial for experimental or special purposes like research and development, crew training, or exhibitions.

The certification process requires a comprehensive review and inspection of the aircraft to verify compliance with FAA standards. This involves demonstrating the airworthiness of the aircraft concerning its design, construction, and maintenance, which can be a complex and rigorous process requiring detailed documentation and possible physical inspections. These certificates are generally sought when UAS are utilized for experimental or unconventional purposes that do not align with routine commercial operations. SACs are more challenging and time-consuming to secure, and they must be issued by FAA inspectors or authorized representatives.

If the UAS is unique, experimental, or in need of a detailed demonstration of safety and functionality, a Special Airworthiness Certificate might be necessary.

3.3 Section 44807 Exemption

3.3.1 WHAT IS THE SECTION 44807 EXEMPTION?

The FAA Section 44807 exemption, originally known as Section 333, enables UAS to operate in the national airspace without a standard airworthiness certificate by using a risk-based approach. This exemption allows the FAA to consider factors such as the UAS's size, weight, speed, and

operational capabilities to grant permission for activities like research and development. The application process requires operators to demonstrate low-risk operation through detailed descriptions of the UAS and proposed operation, aligning with existing precedents for commercial use. Each application is evaluated individually, with the overarching goal of promoting economic activities and adapting regulations to the evolving UAS landscape. Operators seeking this exemption must comply with the detailed application process outlined in 14 CFR Part 11, available in the FAA's public guidance documents. More detailed information can be found at https://www.faa.gov/uas/advanced_operations/certification/section_44807.

If the UAS operation fits well within previously established exemptions and does not involve complex new technologies or unusual risks, the Section 44807 exemption might be easier and quicker to obtain.

3.3.2 HOW TO APPLY FOR SECTION 44807 EXEMPTION

Applying for a Section 44807 exemption, which allows operators to fly UAS that do not meet the standard airworthiness certificate requirements, involves a detailed process as outlined in 14 CFR Part 11 (<https://www.ecfr.gov/current/title-14/chapter-I/subchapter-A/part-11>). The whole petition for exemption can be found at https://www.faa.gov/regulations_policies/rulemaking/petition#exemptions. The following is a step-by-step guide to applying for this exemption (Figure 4).

- a) Determine eligibility. Before applying, ensure that the operation fits the criteria for an exemption under Section 44807. This typically involves operations that the FAA determines able to be conducted safely with a risk-based approach.
- b) Prepare a Petition. The application starts with a petition for exemption. This document must include detailed information about your operation:
 - Description of the UAS: Provide specifics about the UAS, including size, weight, and operational capabilities.
 - Purpose of Operation: Explain the reasons for needing an exemption, such as commercial purposes, research and development, or other activities.
 - Safety Case: Present a comprehensive safety analysis showing that your operation can be conducted safely despite not meeting typical regulatory requirements. Include any risk mitigation strategies you will employ.

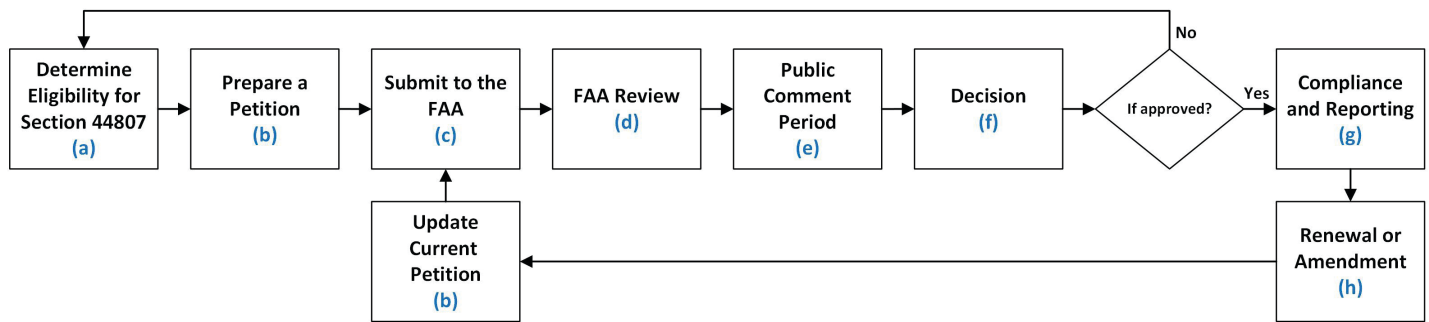


Figure 4. Procedures for applying for a Section 44807 exemption. The letters in parentheses represent the steps listed below.

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- Public Interest Statement: Describe how granting your petition will benefit the public or contribute to the advancement of UAS operations.
- c) Submit to the FAA: Once your petition is ready, submit it to the Federal Aviation Administration. The details on where and how to submit can be found on the FAA's website (https://www.faa.gov/regulations_policies/rulemaking/petition) or by contacting the FAA directly.
- d) FAA Review: After submission, the FAA will review your petition. This process involves assessing the safety case, the benefits to the public, and the overall impact of granting the exemption. The FAA may ask for additional information or modifications to your proposal.
- e) Public Comment Period: Typically, there will be a period during which your petition is open for public comments. This allows other stakeholders and the public to provide feedback or raise concerns about the proposed operations.
- f) Decision: Following the review and public comment period, the FAA will issue a decision. If approved, they will outline specific conditions and limitations under which you can operate.
- g) Compliance and Reporting: If granted an exemption, comply with all specified conditions. You may also be required to provide regular reports to the FAA on your operations and any incidents.
- h) Renewal or Amendment: Be aware that exemptions are not permanent. You may need to apply for renewal or amendment if your operation changes or the term of the exemption expires.

This process can be lengthy and requires a thorough understanding of FAA regulations and a strong safety case. It is often advisable to consult with or hire experts in aviation law or consulting firms that specialize in FAA regulatory processes to assist with the application.

3.3.3 ADDITIONAL REQUIREMENTS — FAA MEDICAL CERTIFICATE

Operators of UAS over 55 pounds are required to hold a current FAA Medical Certificate under a Section 44807 exemption. This involves a physical examination conducted by an FAA-designated Aviation Medical Examiner (AME). More detailed information can be found at https://www.faa.gov/pilots/medical_certification/get.

Firstly, complete the initial portion of the application on MedXpress (<https://medxpress.faa.gov/MedXpress/Disclaimer.aspx>). To locate an examiner, interested parties may visit nearby airports and inquire where pilots typically obtain their FAA Medical Certificates or seek local recommendations for qualified AMEs.

4. Final Application Regulation — FAA Part 137 for Agricultural Operation

4.1 What is Part 137?

The FAA governs the use of aircraft, including UAS, for dispensing or spraying substances through 14 CFR Part 137 (<https://www.ecfr.gov/current/title-14/chapter-I/subchapter-G/part-137>). It applies to operations involving the dispensing of any economic poison or any substances intended for plant nourishment, soil treatment, propagation of plant life, or pest control. Additionally, the regulation covers activities directly affecting agriculture, horticulture, or forest preservation. Note that the FAA categorizes chemicals used as disinfectants for viruses under economic poisons.

Before commencing any dispensing operation, operators must verify whether their planned activities fall under Part 137. If they do, operators must follow the Certification Process for Agricultural Aircraft Operators, ensuring compliance with all regulatory requirements. By adhering to Part 137, operators help maintain the safety and

integrity of agricultural practices while leveraging advanced technologies like UAS for efficient and precise chemical application.

4.2 How to Apply for a Part 137 UAS Certificate

A new streamlined process is now available for applicants seeking a Part 137 UAS certificate. This process allows the FAA to expedite both the Part 137 agricultural UAS certification and the UAS exemption process for visual line of sight operations, as long as these operations adhere to the altitude and airspeed limitations specified by the exemption. Additionally, you can view examples of exemptions granted for UAS engaged in agricultural operations at [https://www.regulations.gov/search?filter=137.41\(c\)](https://www.regulations.gov/search?filter=137.41(c)).

Apply for an Agricultural Aircraft Operator Certificate (AAOC). Ensure that the exemption process is fully completed before applying for the Agricultural Aircraft Operator Certificate (AAOC). To initiate the certification process, applicants must complete FAA Form 8710-3 (https://www.faa.gov/documentLibrary/media/Form/FAA-Form_8710-3.pdf) and submit the form with the exemption number to UAS137Certificates@faa.gov. Then, the FAA will start the AAOC process.

5. Additional Spraying Requirements

5.1 State Pesticide Applicator License

As with ground sprayer use, it is necessary to secure an appropriate state pesticide license to spray legally with a UAS. In Florida, to obtain a State Pesticide Applicator License, applicants must first meet specific requirements involving examinations and fee payments. The process begins by applying for the pesticide applicator license and exam, which can be done through the Florida Department of Agriculture and Consumer Services (FDACS) website (<https://www.fdacs.gov/Business-Services/Pesticide-Licensing/Pesticide-Applicator-Licenses/Pesticide-Applicator-Certification-and-Licensing>). Once applicants receive a voucher number from FDACS, they can schedule their exam. The exams are offered both remotely and at local UF/IFAS Extension Testing Centers.

The key steps include:

1. Applying for the license and exam online.

2. Scheduling and passing the required exam, which typically involves a passing grade of 75% or more on a multiple-choice test.

3. Paying the applicable exam and license fees, which vary based on the specific type of license being sought.

There are different types of licenses depending on the specific pesticide applications, such as structural, lawn, ornamental, or agricultural. Each category may have unique study materials and continuing education requirements for license renewal.

For more detailed information about the types of licenses and the whole application process, visit the UF/IFAS Pesticide Information Office website (<https://pested.ifas.ufl.edu/>).

5.2 Applicator Insurance

In Florida, pesticide applicators must secure appropriate insurance coverage as part of their licensing requirements. The general cost of liability insurance for pesticide applicator insurance can range from \$45 to \$136 per month. These insurance requirements ensure that pesticide applicators are adequately covered in case of accidents or damage during their operations. For more detailed information on licensing and insurance requirements, you can visit UF/IFAS Pesticide Information Office (<https://sfyl.ifas.ufl.edu/online-learning-opportunities/pest-control--pesticide-licensing/>).

6. Special Situations

6.1 Yielding the Right of Way — §107.37(a)

According to FAA regulation 14 CFR § 107.37, small unmanned aircraft must always yield the right of way to all other types of aircraft, including manned aircraft, other airborne vehicles, and launch and reentry vehicles. This means the unmanned aircraft must always give way and cannot pass over, under, or ahead of any other aircraft unless there is a clear and safe distance to avoid creating a collision hazard. The rule emphasizes safety in airspace by preventing potential conflicts and ensuring that unmanned aircraft do not interfere with the operations of manned aircraft or other activities in the national airspace system.

6.2 Operation at Night — §107.29(a)(2) and (b)

Spraying operations are sometimes conducted at night. In the case of night flights, under FAA regulation §107.29, you

can operate UAS at night under a certain condition. The condition is that UAS must be equipped with anti-collision lights that are capable of being visible for at least three statute miles. The lights must have a flash rate sufficient to avoid a collision.

6.3 Operation of Multiple Unmanned Aircraft Systems — §107.35

Under the regulations of the FAA, a pilot is generally allowed to operate only one UAS at a time. However, there are exemptions available that can permit a pilot to legally operate up to three UAS simultaneously. These exemptions must be specifically granted, and the application for such must meet certain criteria that demonstrate the operation can be conducted safely and within the bounds of FAA regulations.

7. Overview of the Whole Application Procedure (Application Checklist)

The FAA uses the gross weight as a standard to identify if a UAS exceeds 55 pounds. The gross weight, also known as maximum takeoff weight, is the maximum allowable weight of an aircraft when it is fully loaded. This weight includes the aircraft itself, fuel, payload, and any other items on board. Therefore, the vast majority of spray UAS fall into the over 55 pound category. For this kind of situation, the concise overview of the entire procedure is as follows:

1. Apply for Part 107 UAS license (https://www.faa.gov/uas/commercial_operators).
2. Register your sprayer UAS. Complete the Aircraft Registration Application (Form 8050-1, <https://www.faa.gov/forms/index.cfm/go/document.information/documentid/185220>).
3. Apply for the FAA Medical Certificate (https://www.faa.gov/pilots/medical_certification/get).
4. Apply for a petition for a Section 44807 exemption (https://www.faa.gov/regulations_policies/rulemaking/petition).
5. Apply for the Agricultural Aircraft Operator Certificate (AAOC) (Form 8710-3, https://www.faa.gov/documentLibrary/media/Form/FAA-Form_8710-3.pdf).

Summary

In summary, the regulatory landscape for spraying UAS involves a thorough understanding of FAA regulations and compliance with several procedural steps. This article delineates the essentials, from basic UAS control under Part 107 to the specialized requirements for operating heavier unmanned aircraft under Section 44807 or agricultural aircraft operations under FAA Part 137. As UAS technology continues to evolve and integrate into commercial and agricultural sectors, adhering to these guidelines will ensure legal and safe operations within the national airspace. By maintaining up-to-date knowledge of these regulations and fulfilling all necessary procedural requirements, users can efficiently harness the potential of spraying UAS to enhance productivity while adhering to safety standards.

For potential UAS operators looking to delve into or expand the use of UAS technology, consistent compliance and awareness of FAA updates are crucial for successful and lawful UAS operations. More information on UAS pre-flight, flight, and post-flight step-by-step instructions are presented by Kakarla and Ampatzidis (2018, 2019) and Kakarla et al. (2019). Kakarla and Ampatzidis (2021) also present and discuss different types of UAS, sensing systems, and software for agricultural applications.

Glossary

Unmanned Aerial System/Unmanned Aerial Vehicles (UAS/UAV): Aircraft that operate without an onboard human pilot. These are typically controlled remotely or autonomously.

FAA UAS Control and Management Policy: This refers to the framework and guidelines the Federal Aviation Administration (FAA) has established to regulate the safe and lawful operation of unmanned aircraft systems (UAS) within the U.S. National Airspace System (NAS). This policy covers various aspects of UAS operations, aiming to ensure the safety, security, and efficient integration of drones alongside manned aircraft.

Low Altitude Authorization and Notification Capability (LAANC): LAANC is a system developed by the FAA to streamline the process of approving drone flights in controlled airspace under 400 feet. It is part of the FAA's ongoing efforts to safely integrate unmanned aircraft systems (UAS) into the National Airspace System (NAS).

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