

# Exam Knowledge Expectations for Apprentice Pilot Certification & Journeyman Pilot Certification

Use these knowledge expectations (KEs) to help study the suggested material, *Pest Control Aircraft Pilot Study Guide* (2006 Edition).

Knowing the information from all of the KEs should prepare you for taking the Apprentice or Journeyman Pilot Certification exam.

## Chapter 1 Laws and Regulations Pertaining to Aerial Application

### A. California and Federal Laws and Regulations

1. Know the sections of California laws and regulations, and federal regulations that deal with aerial application
  - a. Understand requirements for DPR's aerial applicator license/certificate
  - b. Understand regulations covering aerial application including restrictions relating to hazardous materials
  - c. Understand label and state restrictions relating to flying height of applications
  - d. Be aware of congested areas and restrictions and understand differences between FAR part 91 and 137

### B. Pesticide Label Restrictions

1. Recognize that pesticide product labels may or may not provide information on aerial application and may have restrictions regarding aerial applications, such as sensitive areas, buffer zones, and California restricted materials
  - a. Identify where to get information on local restrictions relating to aerial applications
  - b. Interpret label instructions that provide information on aerial uses of pesticides
  - c. Identify how to interpret labels that have no reference to aerial uses
  - d. Understand what "spray quality" means

## Chapter 2 Pest Management

### A. Vegetation Control

1. Know the types of pest management information about which aerial applicators should be knowledgeable and where to obtain the information
  - a. Know what a weed is and identify it
  - b. Understand weed classification and weed life cycles
  - c. Understand the importance of applying herbicides at the correct plant growth stage
2. Know how herbicides are classified
  - a. Understand the differences between selective and nonselective herbicides
  - b. Understand the differences between contact and systemic herbicides
  - c. Understand the differences between preplant, preplant incorporated, preemergence, post plant/preemergence, and post emergence herbicides
  - d. Understand the differences between non-residual and residual herbicides

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3. Recognize the factors that affect herbicide effectiveness
  - a. Understand how leaf shape and surface affect herbicide effectiveness
  - b. Understand how weather conditions affect herbicide effectiveness
  - c. Understand how weed growth stage and age affect herbicide effectiveness
  - d. Understand how soil type affects herbicide action
  - e. Understand how soil moisture affects herbicide action
  - f. Understand how cultural activities affect herbicide action
  - g. Understand the concepts of herbicide tolerance and herbicide resistance
- B. Insect and Mite Control
  1. Recognize characteristics of pest insects and mites
    - a. Know basic features used to identify insects and mites
    - b. Understand general insect and mite growth cycles
    - c. Understand growth stages of mites and insects in order to achieve optimum control
    - d. Understand that different classes of insecticides work on different insect life stages
    - e. Recognize that different classes of insecticides work on different types of insects (piercing, sucking vs. chewing, etc.)
  2. Know how different classes of insecticides and miticides work
  3. Recognize factors that affect insecticide and miticide effectiveness
- C. Plant Disease Control
  1. Recognize what can cause plant disease symptoms
    - a. Understand why you need to correctly identify the cause of plant disease symptoms
    - b. Know environmental conditions that can stress plants and cause abnormal growth or disease-like symptoms
    - c. Understand why it is necessary to recognize and relieve environmental stress on plants
  2. Recognize pest organisms that can cause plant diseases
    - a. Understand that plant disease identification is based on symptoms and laboratory tests
    - b. Understand the general characteristics of fungi that cause plant diseases
    - c. Understand how most fungi reproduce and how they cause plant diseases
    - d. Understand the general characteristics of bacteria that cause plant diseases
    - e. Understand what a virus is and the types of plant diseases they cause
    - f. Understand what nematodes are and how they cause plant diseases
  3. Know conditions necessary for a plant disease to develop

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4. Understand how plant diseases can be controlled
  - a. Understand how protectant fungicides work
  - b. Understand how eradicant fungicides work
  - c. Understand how systemic fungicides work
  - d. Understand factors that affect fungicide effectiveness
- D. Aerial Application of Pesticides as a Component of Pest Management Programs
  1. Recognize the general requirements for effective pest management through aerial application of pesticides
    - a. Understand the advantages and limitations of applying herbicides by air for vegetation and weed management
    - b. Understand the advantages and limitations of applying insecticides and miticides by air for controlling insect and mite pests
    - c. Understand the advantages and limitations of applying fungicides by air for controlling or suppressing plant-infecting organisms
  2. Understand the long-term objectives of integrated pest management (IPM) programs

### Chapter 3 Pesticide Application Safety

- A. Mixing and Loading
  1. Know how to work safely around aircraft when mixing and loading pesticides
    - a. Describe the main considerations for mixing and loading operations
    - b. Describe the basic requirements for mixing and loading equipment
    - c. Understand what is meant by a closed mixing system
    - d. Understand the safety features required for mixing and loading equipment
    - e. Identify when pesticides should be mixed and the order of mixing pesticides in a tank mix
    - f. Identify the general features of dry loading equipment
    - g. Identify who should be responsible for ensuring mixers are trained, ensuring that the pesticide is registered for aerial use, and that mixing instructions are available
- B. Pilot's Equipment
  1. Understand the personal protective equipment (PPE) requirements for pilots when entering and exiting aircraft, cleaning windshields, making nozzle adjustments and performing other tasks outside of the cockpit that requires contacting contaminated equipment
- C. General
  1. Know safe pre-application procedures for aerial application
    - a. Recognize the importance of safe operating procedures for everyone involved in an aerial application operation
    - b. Describe the safety requirements for the person performing mixing and loading tasks, including where to walk around the aircraft

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- c. Describe the requirements for pilot and crew personal habits – including physical and mental alertness and the use of alcohol and drugs
- d. Understand the requirements for regular aircraft and application equipment maintenance
- 2. Know the most serious hazards associated with aerial application and how to reduce these risks
- D. Protecting the Environment, Sensitive Areas, and the Public
  - 1. Recognize ways to prevent harmful environmental effects to agricultural land and sensitive areas while making aerial applications
  - 2. Know how to protect people from exposure during an aerial application
- E. Emergency Procedures
  - 1. Recognize the reasons for most accidents in aerial application and understand how accidents can be reduced
  - 2. Know why load jettison may be required and understand its effects on the aircraft
  - 3. Know pilot procedures if an aircraft crashes
  - 4. Know ground crew procedures if an aircraft crashes

### Chapter 4 Application Technology

- A. Know safe application techniques that must be practiced by the pilot
  - 1. Understand how to avoid exposure to spray during an application
  - 2. Understand the flight dynamics of application techniques
  - 3. Understand the importance of allowing sufficient time for making turns during an application
  - 4. Know how to recognize obstacles in and around the field being sprayed
  - 5. Understand the importance of looking back and looking forward during applications
  - 6. Understand the importance of flying contours when making applications on uneven terrain
  - 7. Understand the safety precautions when flying under wires
- B. Dispersal and Guidance Systems
  - 1. Know what an aerial application dispersal system is and its general specifications
    - a. Be familiar with the major components of dispersal systems
    - b. Understand the necessary requirements for hoppers and tanks
  - 2. Recognize the various types of spray pumps and how they are powered
    - a. Understand the features and advantages of fan driven pumps
    - b. Understand the importance of proper placement of fan driven pumps
    - c. Understand the features and advantages of hydraulic pumps
  - 3. Know where filters should be located in the system, their function, and when to clean them
  - 4. Know where pressure gauges should be positioned and how they should be checked for accuracy
  - 5. Understand the purpose of dry break couplings and how they function
  - 6. Understand the purpose of check valves or positive shut off valves on nozzles

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7. Understand the purpose of a suck back spray valve and how it functions
  8. Understand the requirements for pipes, hoses, and fittings in an aerial dispersal system
  9. Understand the requirements for spray booms and boom couplings
  10. Know what spray nozzles do and identify the main types of nozzles
    - a. Know how to select the correct type and number of nozzles based on the required spray output and the manufacturer's specified flow rates
    - b. Know which factors must be considered when selecting nozzles
    - c. Understand how droplet size varies for a given nozzle setup
    - d. Know what factors affect nozzle wear
    - e. Understand proper nozzle orientation and placement
  11. Understand how electronic flow meters work
  12. Understand how typical dry material spreaders work and be familiar with their components
  13. Know the various types of navigation and swath guidance systems
    - a. Be familiar with smoke generators
    - b. Be familiar with global positioning systems
- C. Application Procedures
1. Understand back and forth and racetrack application patterns and when they are typically used
  2. Know the importance of field exit and entry angles when making applications
  3. Understand why speed during an application should be constant
  4. Understand what trimming runs or headland passes are and when they should be used
  5. Know the importance of the first and last flights of the day
  6. Know the standard precautions for ferrying to and from a treatment site
  7. Know what to check after arriving at a treatment site and before beginning applications
  8. Understand the guidelines to observe during an application
  9. Know the methods to use to ensure that the correct number of swaths is treated
- D. Swath Characteristics
1. Understand what a uniform distribution pattern is
  2. Understand what a triangular distribution pattern is
  3. Understand what a trapezoidal distribution pattern is
  4. Know the differences between "total swath width" and "effective swath width"
  5. Recognize the factors that affect swath characteristics
  6. Understand how liquid swath characteristics can be determined
  7. Understand how granular swath characteristics can be determined
  8. Understand how changing the droplet size affects drift
  9. Understand how droplet size is affected by increasing nozzle orifice size

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10. Understand how pressure affects output and droplet size
  11. Understand how granular swath width varies with airspeed and output rate
  12. Recognize how air speed affects the distribution of deposited material across the swath
  13. Understand how height of application affects swath width
  14. Understand how fixed wing aircraft wingtip vortices affect spray patterns
  15. Know the procedure for determining the locations of the outboard nozzles on a spray boom
  16. Know how propeller or rotor wake affects droplet distribution and how to compensate for this
- E. Calibration
1. Understand the term “flow rate”
  2. Understand why flow rate is calibrated and when calibration should be done
  3. Know the formulae for calculating flow rates and output
  4. Recognize what to check if flow rates are too high or too low
- F. Meteorology
1. Know why weather should be monitored and of what in particular the pilot should be aware
  2. Understand the term “density altitude”
  3. Understand how air density can affect aircraft engine power, takeoff and landing, rolls, and climb capability
  4. Understand how air density varies with temperature, pressure, and humidity
  5. Understand the problems associated with wind shift
- G. Drift and Offsite Pesticide Movement Control
1. Know the hazards from offsite pesticide drift
  2. Recognize ways that offsite drift problems can be minimized
  3. Understand the classification of droplet sizes and the importance of droplet size with respect to drift and coverage
  4. Recognize which types of pesticides can be applied with larger droplet sizes and which require smaller droplet sizes
  5. Know the definition of VMD (volume median diameter) and what this measurement is used for
  6. Understand how orifice size, nozzle orientation, pump pressure, and nozzle placement on the boom affect droplet size and offsite pesticide drift
  7. Understand how evaporation can affect droplet size and recognize what conditions promote evaporation
  8. Know how to minimize offsite movement caused by evaporation
  9. Understand how wind and thermals can affect drift and offsite movement
  10. Know what an inversion is, how it can be identified, and how it can result in offsite movement