

Lesson 1 Rules and Regulations

The first unmanned aircraft system (UAS) flight occurred when the Montgolfier brothers launched balloons in France, 1782. In 2016 an estimated 2.5 million drones were sold in the United States, totaling around \$799 million (business insider). That number is expected to triple by 2020. With that many drones, problems were bound to arise.

In Module One, we dive right into the laws that govern the sUAS community. Title 14, Part 61, and most importantly Part 107, have provided the foundation for the do's and do not's of sUAS operation. We will discuss the role of the Federal Aviation Agency (FAA) and its relation to the UAS community. Topics will include eligibility, required documentation, maximum altitude, the right of way (hint: it's never the sUAS) and more).

This lesson can be technical and overwhelming. Take notes, write down the acronyms, and use the links below to research topics that require clarification. Grab a coffee, settle in, and let's fly!

Learning Objectives:

- Describe the FAA's role and importance in UAS regulations.
- Understand the operating rules for small unmanned aircraft systems in relation to people, vehicles, and safety.
- Know the role and responsibilities of the Remote PIC.

Lesson 2: Airspace

If you think the street traffic around Los Angeles is terrible, try the skies! When researching this lesson, I came across a neat article ["A Brief History of Airspace Design."](#) It describes pilots trying to "navigate invisible highways with blindfolds and a few blinking lights and there's a beautiful design that makes it all work."

That is the perfect analogy for the United States' airspace. In this module you will learn the 5 different classes (B, C, D, E, and G) of airspaces you will encounter as a sUAS pilot. You will also learn about special airspace zones such as Military Operation Area (MOA) and associated hazards.

Pay close attention, on average 15%-20% of the knowledge exam focuses on this topic. I guarantee you will need to know the color of each airspace and whether the line is solid or dashed.

Learning Objectives:

- Differentiate between the airspace classes with an emphasis on controlled vs uncontrolled, shape, and aircraft allowed.
- Explain the difference between MSL and AGL and identify the two on a sectional chart.
- Understanding the hazards of Warning Areas, Prohibited Areas, Restricted Airspace, Military Operation Area, and Alert Areas.

Lesson 3: UAS Weather & Weather Sources

Weather does not seem like a tricky phenomenon in southern California. San Diego gets an average of 10.4 inches of rain per year, while San Marcos (where Palomar College is located) is at 14 inches per year. However, there are still plenty of other weather factors that can influence sUAS performance such as wind, extreme heat, the marine layer, and more.

Module 3 consists of very dense videos, especially the first two lessons. METAR and TAFS can be very tricky to decipher the first couple of tries. Practice until you feel comfortable because these will definitely appear on the knowledge exam. Don't be discouraged!

You will also learn about clouds, stable vs unstable air (several questions about this on the exam), and weather abbreviations. I strongly suggest you have the METAR Cheat Sheet and Weather Abbreviation Guide on hand, either printed or electronically for this module.

Learning Objectives

- Interpret a METAR map from the Aviation Weather Center to determine whether appropriate weather conditions exist for a sUAS flight.
- Explain the characteristics of stable vs unstable air.
- Understand the effects of heat and cold in relation to altitude and their effects on the sUAS.

Lesson 4: Loading & Performance

While pizza and package delivery by UAS might not exist just yet, they are capable of carrying payloads. The DJI Phantom 4 can carry just over a 1lbs payload safely. Drones that are considered heavy-lift carry over 10 lbs with some consumer models

even able to handle 40 lbs. One drone, built by Norwegian company GRIFF is said to be able to carry 400 lbs.

While the carrying capacity of drones steadily increases, it also leaves more room for disaster. As several airplane crashes have proved if the weight is not distributed correctly or the aircraft is overloaded, it will crash. While loss of life is reduced when flying sUAS, there is still a risk (especially of property damage).

Module 4 focuses on the weight, balance, and performance of a UAS. You will learn about load factors, the transportation of hazardous materials (don't), where to find information about your aircraft's weight and balance data and more. Take detailed notes on the Load Factor Chart and how altitude affects propeller efficiency as these will likely appear on the knowledge exam.

Learning Objectives

- Calculate load factor from a given angle of bank using the load factor chart.
- Identify what item to reference to review any manufacturer weight and balance data.
- Explain the relationship between altitude and propeller efficiency.

Lesson 5 Crew Resource Management

The sUAS is the focal point of the flight operation, but it is not the greatest resource you have available. That would be your crew. Effective communication and a cohesive team makes the world of difference when planning, executing, and wrapping up a flight operation. Unless you are flying as a hobbyist, you will have to work in a team of at least two, much of the time as three. There are a number of occasions where a visual observer has helped me greatly (their eyes are way better).

This module is learning about the crew resources at your disposal and some of the hazardous attitudes when flying. Regulations pertaining to flight operations and alcohol are also in this chapter. Sorry to ruin it, but you won't be using your Phantom to fetch your beer.

I suggest downloading or printing the PowerPoint. At least one question from every part of this module will be present on the knowledge exam. During my exam, I encountered three questions on hazardous attitudes alone and two on alcohol.

Learning Objectives

- Explain the roles of each crew member.
- Identify the 5 hazardous attitudes.

- Recall the regulations between alcohol and flight operation.

Lesson 6 Airports and Field Operations

The greater Los Angeles area has a total of 35 airports. Only five are international/domestic service airports, the rest are made of military, cargo, local towered, and non-towered. Unless you plan to fly your sUAS in only really remote areas, chances are you will have to interact with an airport traffic and airport traffic control (ATC) at some point. Not to mention all of the powerlines, buildings, and other obstacles associated with urban development. These might even be the features you are inspecting.

Module 6 focuses on reading sectional charts and interpreting symbols for information. That airport symbol is more than an "airport here" flag; it provides information about the common traffic frequency, longest runway, weather frequency, and much more. Lesson 6 represents the largest portion of the knowledge exam, at least 35% to as much as 50%!

Questions on the knowledge exam will include

What is the common traffic frequency at a designated airport?

How high is the tower southeast of a specified tower? (make sure you read the right number, one is AGL the other MSL)

What altitude could you fly about a tower you are inspecting? (math is required)

What does the purple flag at location X represent?

This is a long lesson so it will be split into two weeks. Be thorough as you watch the video clips. Rewatch clips you do not understand. I highly recommend you brush up on these lessons right before you take the knowledge exam.

Learning Objectives

- Diagram the Airport Traffic Patterns using the terms Upwind, Crosswind, Downwind, Base, and Final.
- Interpret the various VFR section chart symbols.
- Describe the airport information available from a sectional chart.

Lesson 7 Radio Communications

If you have watched any airplane disaster movie, you will recall the white-knuckled pilot saying into the radio, "Mayday, MayDay" before, hopefully, performing daring feats to save the lives of passengers and crew. Flying a sUAS will not be anywhere near this drastic and most of the time airport traffic control (ATC) does not want to hear from sUAS operators. It's more likely you

will use the radio to simply listen for any incoming aircraft that might impact your flight path. While it is unlikely you will have much dialogue, a remote pilot is required to know the procedures in case contact is needed.

Module 7 focuses on proper radio procedures. How to identify radio frequencies and when it is appropriate to contact a control tower. Questions on the knowledge may pertain to identifying a control tower frequency and hearing another aircraft on the radio and determining its location.

Learning Objectives

- Describe when it is appropriate to use a radio to contact a control tower.
- List the sources where a pilot can find control tower frequencies.

Lesson 8 Emergency Procedures

Accidents happen; it is a fact of life. Eventually, something will go wrong with your sUAS or flight operation. Hopefully, this will be restricted to a damaged piece of equipment, but what if the worst happens and someone is injured. I recently heard a pilot talk about when he lost communication with his phantom, and it went through a woman's patio window. The homeowner was not hurt, severely startled, but the only damage was to the door. The pilot had flight insurance and the patio door was replaced. While unfortunate, it could have been much worse.

Module 8 is about understanding common emergency situations and being prepared for them. Before each flight, you should create an emergency procedure in case the worst happens. I guarantee a question about the time a pilot has to submit a report after an accident will be on the knowledge exam.

Hope for the best and prepare for the worst. A cliché but very true as a sUAS pilot.

Learning Objectives

- Describe the FAA's qualifications for a serious accident and the timeframe in which a pilot must submit a report.
- Differentiate between a lost link and a fly away, as well as the appropriate procedures for both.

Lesson 9 Preflight and Maintenance

Back in Module 1, the importance of a flight logbook was discussed. Equally as important as keeping track of flight hours is logging maintenance/repairs done on your sUAS. In case there is an emergency and an accident occurs as covered in Module 8, a representative from the FAA will require your logbooks. Improper accounting of your flight logbook, maintenance logbook,

or preflight checklist may result in:

- 1) a fine up to \$100,000
 - 2) suspension or revocation of your sUAS remote pilot certification
 - 3) a civil penalty as well as a fine up to \$100,000
- (Rupprecht Law.com)

This module will discuss maintenance logs and preflight checklists. Pay close attention to the maintenance schedule as it often appears as a question on the knowledge exam. The video portion of the module is fairly short (yay). By the end you will have created your own flight and maintenance log books and preflight checklist.

Learning Objectives

- Detail the contents required in a sAUS Maintenance logbook.
- Explain the importance of a preflight checklist and maintenance logbook in relation to reporting to the FAA.

Lesson 10 Boot Camp

Since the Part 107 knowledge exam became available to the public in the Fall of 2016, the questions have continued to evolve. The wording of the questions remains frustratingly confusing and new questions seem to appear with every account I hear/read about.

Module 10 consists purely of questions that multiple people have reported seeing on the exam. Many of these are extremely tricky and could have two potential answers. Pay close attention to the wording of each question.

The final exam is right around the corner. I have posted a number of practice exams and study guides in Module 10, which I strongly suggest you review them. Take a practice run through the 3DR exam and see how you perform. This will be a good gauge of your strengths and what areas to improve before the final. Good luck!

Learning Objectives

- Identify and answer questions likely to appear on the Part 107 knowledge exam.

Lesson 11 Waivers

This module will discuss the process of submitting a waiver. Remember, this is *done* only when you believe an operation may require infractions of the Part 107 regulations such as flying at night, in certain airspace, over 400 feet, and others. This must be done using the FAA Drone Zone portal.

No quiz, assignments, or discussions. As with Module 10, I have included the links to several practice exams. Module 12 is your final exam; I hope you have been studying.

Learning Objectives

- Understand the waiver process and the necessary time to submit a waiver.

Lesson 12 IACRA

This is a bonus video that I highly suggest you watch. This is what will happen once you pass your Part 107 knowledge exam. After you pass the exam, you must register with [Integrated Airman Certification and Rating Application \(IACRA\)](#) using your 17-digit exam ID. Enter your personal information and locate your exam. If the system cannot find your exam, don't freak! This can take 48 hours. My exam did not appear until close the 48-hour mark.

Once you put your digital signature on a few things, the application will be processed. In about 24 hours you will be given a temporary license. The official license should arrive in the mail in about 10 days. Congratulations, you are officially a sUAS pilot.

Final Exam

You made it! After countless sectional charts, enough METARS to make your head spin, and more aviation acronyms than air traffic in Los Angeles, we have reached the end of the course. I want to thank you for all of your dedication and hard work throughout this course. When you pass the Part 107 knowledge exam, please let me know.

I wish you all the best luck on your final, the Part 107 knowledge exam, and wherever future skies may lead.

Learning Objectives

- Give it your all.



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