FAA §107 UAG

REMOTE PILOT STUDY GUIDE

INCLUDES REMOTE I.D. update

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The Drone Professor

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Revision 35: April 27, 2023

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AIRPORT OPERATIONS AND AERONAUTICAL CHARTS

Why do we need to know about airports? We probably won't be flying a drone at an airport, right? But if we are operating in the vicinity of an airport, with permission from the FAA, requested at **FAAdroneZone.FAA.gov** or through the Low Altitude Authorization and Notification System (LAANC), we need to be aware of where the traffic is. For example, if the pattern is at 1,000 feet, at 1.5 miles from touchdown, a GA, or General Aviation aircraft is approximately 500 feet AGL. That's getting close to the 400 -foot UAV operating ceiling, and there is no guarantee that the pilot won't come in low. Maybe it's a student pilot practicing approaches, or someone running short of fuel, or for some other reason, is not at the correct approach altitude.
Aeronautical charts and NOTAMS account for a large portion of incorrect answers on the remote pilot certification (UAG) test. What you see here are the basics, but understanding can only come from practice.

Sources of Airport Data

- **Sectional charts** provide a reference for airport locations and dimensions of restricted areas around them.
- The **Airport/Facilities Directory** contains information such as radio frequencies and phone numbers for Air Traffic Control (ATC) as well as the list of runways and other details.
- **Notices To Airmen** (NOTAMS) provide the most current information and updates.

Types of Airports

There are three types of airports: Civil, Private and Military. These can either be towered (ATC operated) or non-towered. Some airport towers are only in operation part time. Information on when those towers are in operation can be found in the airport data.

NOTAMS

Notice To Airmen contain current information related to:

- Hazards, such as airshows, parachute jumps, kite flying, lasers, rocket launches, etc.
- Flights by important people such as heads of state. These often appear as TFRs or Temporary Flight Restrictions.
- Closed runways because of repairs, accidents, floods, etc.
- Inoperable radio navigational aids
- Military exercises with resulting airspace restrictions
- Inoperable lights on tall obstructions like radio towers or buildings.
- Temporary erection of obstacles near airfields (e.g.k cranes)
- Passage of flocks of birds through airspace. (This category is known as a BIRDTAM)
- Notification of runway/taxi/apron status with respect to snow (SNOTAM), ice and standing water.
- Notification of an operationally significant change in volcanic ash or other dust contamination (ASHTAM)
- Software code risk announcements with associated patches to reduce specific vulnerabilities.

It would seem that most NOTAMS contain warnings about inoperative tower lights and UAV operations. (Review section 5-1 in the FAR/AIM)

Aeronautical Charts

Aeronautical charts play an important role in aviation. Charts tell us where airport boundaries and military operational areas or MOAs are located. They show air routes, hazards to be aware of and more.
Unfortunately, reading charts generates a large portion of incorrect answers on the UAG exam. The key to reading charts is knowing how they work. The chart LEGEND lists the symbols and what they mean.
Aeronautical charts, once printed on large, folded sheets of paper, can now be downloaded in PDF form online at the FAA website. They are also available for display on tables.

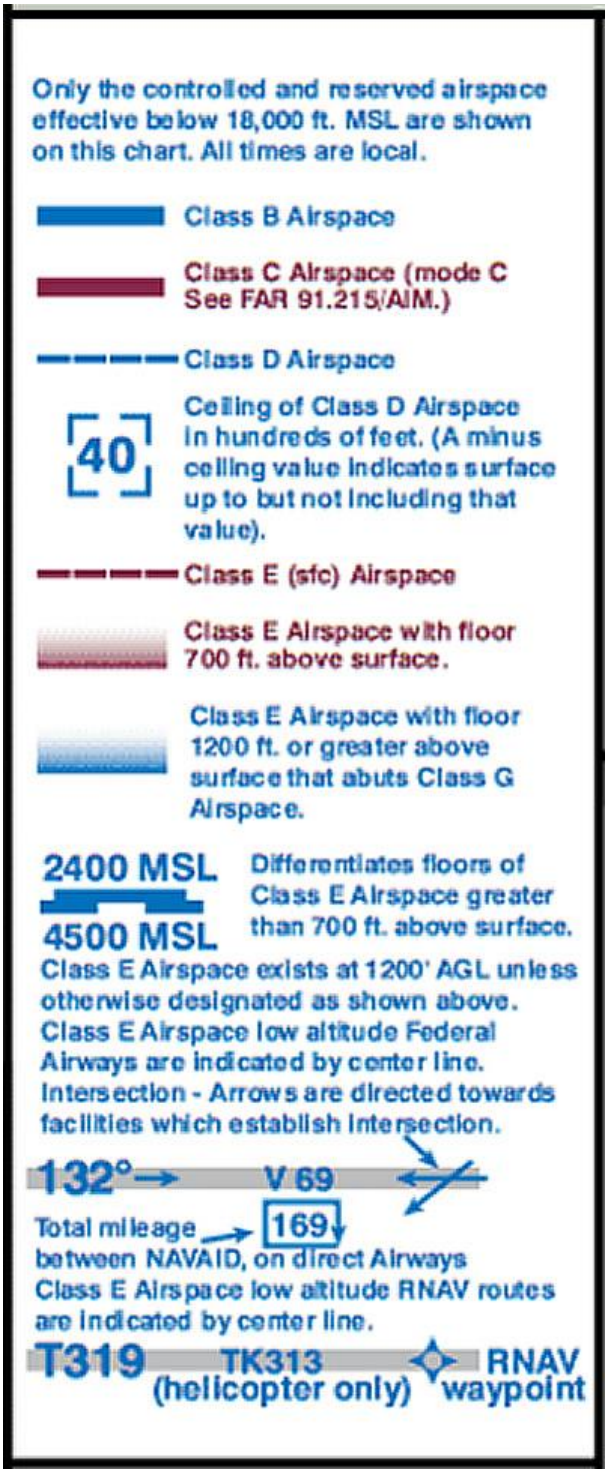
Aeronautical maps are referenced to latitude and longitude, measured in degrees, minutes and seconds, overlaid with magnetic compass corrections. The way to remember the difference between latitude and longitude is to imagine a ladder. Latitude is the rungs of the ladder going up and down, north and south. Latitude forms the poles of the ladder, measuring east and west.
The markings for Latitude appear along the Latitude lines and the markings for Longitude appear along the Latitude lines. Each major marking is a degree, each tick mark is a minute. There are medium tick marks that appear every 5 minutes, larger tick marks every 10 minutes. A larger tick mark appears at 30 minutes and is often mistaken for the next degree. There are 60 seconds between the minutes, but they do not appear on the charts. It might be easier to visualize using a ruler.

Source: FAA charts

Each minute of latitude is spaced at one nautical mile, and each degree of latitude is 50 nautical miles. Degrees of longitude are only 60 miles apart at the equator because the lines of longitude converge at each of the poles. 60 tick marks up from the 33-degree -Latitude line in this example is 34 degrees. 60 tick marks left of the 81-degree line is where we would find the line for 82 degrees West Longitude. By the way, the circle R that resembles the old RadioShack logo is the location of a private airport.
Aeronautical charts also show Military Training Routes, or MTRs, which are something like interstate highways in the sky. MTRs are divided into two types: Instrument Routes (IR) and visual routes (VR). Each route is identified by either of these two letter designations, followed by either four or four digits. Three digits identify routes with at least one leg above 1,500 ft AGL. (e.g., IR156). Four digits are used to designate routes below 1,500 ft AGL (e.g., VR-2430)/ UAV pilots need to be aware of four-digit routes because can appear at low altitudes. Military Training Routes may extend from the surface upwards and are subject to change every 56 days. While the routes appear on the navigational charts, they are subject to change every 56 days. For that reason, the latest information can be found online in the digital Chart Supplement.
Don't confuse VR routes with Victor Airways, which include the airspace extending from 1,200 feet AGL up to but not including 18,000 feet MSL, or FL180. Those airways are designated on sectional and IFR low altitude en route charts with the letter "V" followed by a number. (e.g., V23) Flights on Victor routes can be IFR or VFR. These routes, marked in blue, are the high altitude routes typically used by airlines.
There are areas on the charts that mark restricted areas like military operational areas (MOAs) and firing ranges. The chart also lists contact numbers for the MOA facilities.
The key to using charts is the Chart Legend, which is found, among other places, on the first page of the appendix of the Testing Supplement (FAA-CT-8080-2) which will be provided for your use at the testing site. There will be questions on the test that will refer to symbols and information on that page. Knowing where to find that page almost turns some portions into an open-book test. Different types of airports have different designations on the charts. Heliports are identified by a circle H. There are also symbols for hang glider areas, high altitude stationary balloons, and navigational waypoints. The LEGEND will help you identify these icons.

Source: FAA

The airspace of a Class D airport resembles a barrel, while Classes C and D look like a layer cake turned upside down. Class B has three layers while Class C has only two. A sectional chart shows the upper and lower limits of each layer or shelf. A UAV can operate under the shelf of a controlled airspace assuming that the shelf does not extend to the surface. Because the surface of the ground varies, airplanes have altimeters calibrated to Mean Sea Level. For that reason, most of the altitudes on the charts are in MSL.



You will need to know how to identify Class B, C, D and E airspace by the color and shading. An easy way to remember might be “B” for busy, “C” for Congested, and “D” for daylight. A solid blue line indicates a Class B airport while a solid magenta (red?) indicates Class C. Class D is marked by a dashed blue line. There are several indications for Class E. From the surface, Class E is marked by a dashed magenta line. From 1200 feet AGL it becomes a blended or blurred blue line. Finally, Class E from 700 feet AGL is marked by a blended Magenta line.

The illustration below shows that the ceiling of a Class D airspace shown with a number inside a square bracket is in hundreds of feet. The example shows 40, meaning 4,000 feet. If the marking is a number with a minus sign,

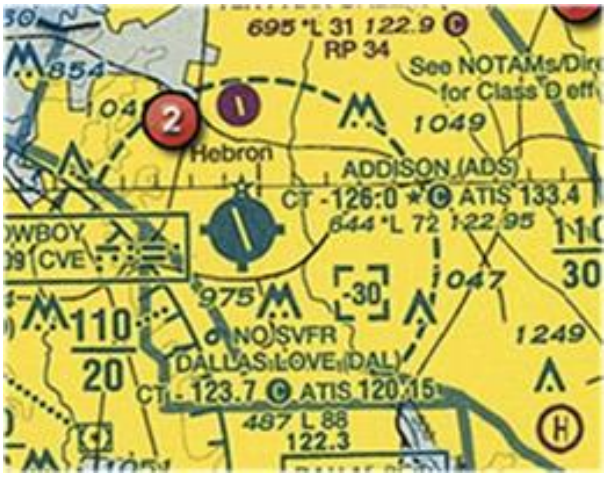
like [-40] that means that airspace extends up to but not including that altitude. That occurs when the airspace above is another controlled airspace, like a Class B.
Don't confuse the solid lines with shaded lines. Blue lines are Class B but a shaded blue line is Class E at 1200 feet or above. A shaded magenta line marks a Class E airspace with a floor of 700 feet above the surface, while a blue shaded line means Class E airspace with a floor of 1200 feet or greater above the surface where it meets a Class G airspace.

The only way to become confident and proficient about reading charts, and answering test questions about charts, is to practice. Look up an airport online and find the latitude and longitude coordinates. Then find that airport on a chart. Practice using the chart Legend, which you can find online, to identify other points on a chart. Notice what the different colors mean for different types of airports.

This is the chart for KPNS, the airport at Pensacola, Florida. From what you have learned, can you identify what type of airport it is? If you said Class C (or "Charlie"), you are correct. The large blended magenta circle indicates the boundaries of Class E or "Echo" airspace surrounding the airport. You will also note there are two other airports shown in this chart sample.

You can remember Class D by the word Daylight, because the tower at those airports is often open only during the day and at night it becomes Class E airspace when the tower closes and that airspace is no longer "controlled".

The various numbers mark the vertical separation of the layer of the class of airspace. For example, the 42 with a line over the letters SFC mean that airspace begins at the surface and extends to 4,200 feet. On the charts the last two digits are always left off to save space.



When the chart is complex with overlying shelf areas, we use the legend to determine that the area indicated by the red dot "2″ is inside a dashed line, which means that Addison, near the town of Hebron, is a Class D airspace, and the space above it is Class B airspace at 11,000 feet. You will notice this airport has a single runway. The airspace above the Hebron airport is up to but not including 3,000 feet. We know that by the -30 in square brackets. Not all airspace takes the shape of a circle. In this situation, the southwest portion of the circle

is blocked by the boundary of an inner shelf of the Class B airport. What else can we learn from this chart? Can you find the helipad?

Source: FAA charts

Refer to this example. When we see a large number with a small number next to it on a chart like the large zero with the smaller seven, that means the average terrain in that sector is 700 feet. We get that when we add on two zeros to the 7. Notice that the airport airspace is not round. There are extensions due to certain circumstances at this airport. There are two sections of class E airspace attached to the Class D. The magenta line with hash marks indicates a restricted airspace adjacent to the Corpus Christi Class D airspace. The ceiling of the Class D airspace is 2500 feet indicated by the 25 in brackets.

In the next example, we add two zeros to the 110 over the 60 to give us a floor of 6,000 feet and a ceiling of 11,000 feet. Taking what we learned earlier, we notice the circle “R” for the Flying Oaks privat airport. The yellow area indicates a more heavily populated area.

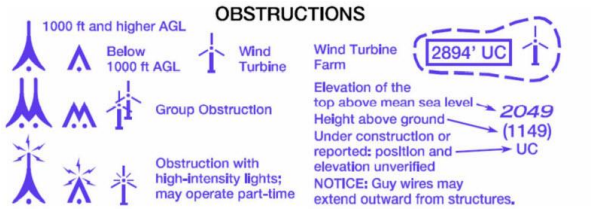
A symbol which as been recently added is the magenta diamond. That marking is important to drone operators because it indicates stadiums that may be affected by a sports TFR or Temporary Flight Restriction. The circle in the lower section of this sample is the designation for a radio navigation aid. You can also detect the outline of a Class D airspace with a floor of 1,800 feet and a ceiling of 10,000 feet MSL. There are several towers in the area, including the Seattle Space Needle.

One example of a question that could appear on an FAA test might ask about the elevation of the top of an obstruction such as a radio tower (or the Space Needle). The possible answers will be in

MSL and AGL. If the question asks the elevation of the tower, the answer would be the height of the tower plus the ground elevation. That would result in the height in MSL. On the chart, the number next to the tower is the elevation in MSL. You will also notice another number in parentheses below that number. That designates the height of the tower or the elevation above the ground. If the question asks for the height of the tower, the answer

would b in feet, AGL. In the example above, there is a tower in the lower right corner that is 1,745 feet MSL and 321 feet AGL. You will notice there are also several tall buildings on this chart.

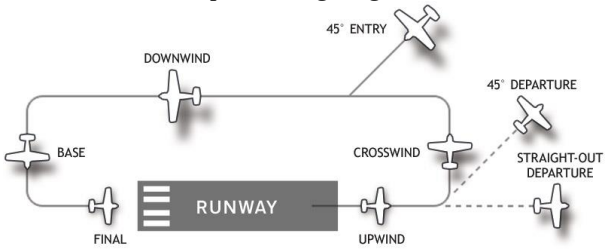
Aircraft need to stay 1,000 feet above obstructions in congested areas. Using the same process and this chart map, what minimum altitude is required to fly over the TV towers to the west of Cedar Hill? We know that Cedar Hill is a congested area by the yellow area. The chart indicates the height of the towers at 2,449 feet. We would add 1,000 to that number for the answer, which is 3,449 feet MSL. The height of the tower is the number in parenthesis, or 1,640 feet AGL.



We know from this chart that the towers have high intensity lights. We know from the shape of the symbol that the towers are higher than 1,000 feet. The same kind of designations also apply to windmills.

Air Traffic Patterns

Notice the designation of the aircraft in the sample landing diagram.

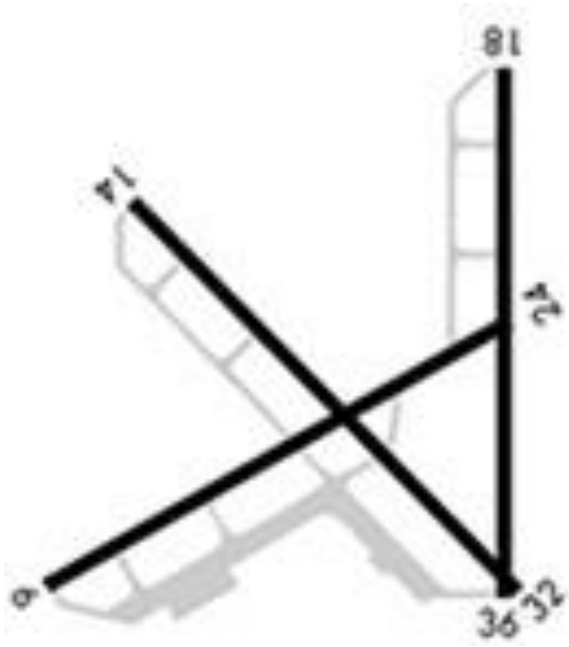


The UAV operator needs to be aware of where the runways are and which way the wind is blowing. Literally. Planes land and take off into the wind, that is aimed toward the small end of the windsock. If there are multiple runways, the designated runway may change in response to a change in the wind pattern. The runway orientation is based on the compass headings of the prevailing winds at that location. The runways are numbered with compass headings with a zero removed. Thus, the runway facing south (180 degrees) would be runway 18.

The opposite end of that runway would be designated 36, because there is no runway zero. In some cases, there may be two parallel runways. Each end would then be designated by the direction plus the letter “L” or “R”. The

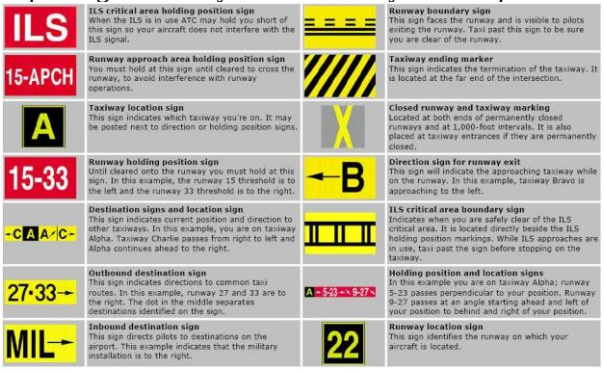
diagram above shows an airport with a “left pattern”. An airport could have a right landing pattern. In some cases, one pattern is used for fixed wing aircraft while the other is designated for rotary-wing aircraft or helicopters. The airport information will indicate either left or right pattern with the letters “LP” or “RP” on the runway diagram.

There could be a question on the FAA test something like this:



You are shooting aerial video with your sUAS, operating with authorization, just outside the west boundary of a non-towered airport. You are monitoring the CTAF radio frequency when you hear a pilot announcing “downwind for left final on runway 6″. Where would you look to find the plane?
We know that runway 6 means a 60-degree heading for landing. That would be the southwest side of the airport. Downwind means the plane is heading in the opposite direction of the runway, which menas a southwest heading, or 180 degrees from 60, which is 240 degrees.
That means you would look for the plane on the northwest side of the airport, at pattern altitude of 1,000 feet. In a left pattern the plane will be turning left or southeast for the base leg of the approach (90 degrees to the runway) and then left again, descending for the final approach for runway 6.
Do planes always run on the correct runway? No, planes do sometimes land on the wrong runway or even in the wrong direction on the right runway. That is why it is important to listen to radio communications to maintain situational awareness.

Airport Signs and Markings
Become familiar with basic airport signs so that you can correctly answer questions on the FAA test.



Source: CFI Notebook Website via StackEnchange.com
A black background tells where we are. A number is a runway, and a letter is a taxiway. Numbers posted along a runway indicate the remaining runway in thousands of feet. Hold Short markings (looks like a double highway

centerline turned 90 degrees) indicate where approval is required to cross from the solid line (a taxiway) to a runway but is not required when passing from the dashed line when leaving a runway. Arrows indicate directions to runways or taxiways.

Things to remember about airports:

- Planes generally land into the wind (the small end of the windsock)
- The active runway is the number closest to the wind heading
- The runway number is the compass heading with the zero left off. The north end of the north/south runway is runway 18 and the compass heading is 180 degrees.
- Planes do not always land where they should. They can appear unexpectedly at low altitudes for many reasons, including pilot error and mechanical problems.
- A plane that does not appear to be moving is the hardest to see and may be headed directly toward us.

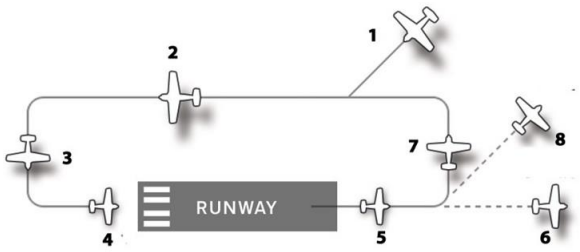
Remember the colors of wing lights. A red wing light means a plane is passing in front of us from left to right. A green light on the left side of a plane facing us is coming toward us. Questions like this can appear on a test. Study references for this lesson include AC107-2 and Chapter 13 of the Pilot's Handbook: Airport Operations.

Chapter 11 Practice Test:

1: The three types of airports are Private, Military and:
A) Municipal
B) Public
C) Civil

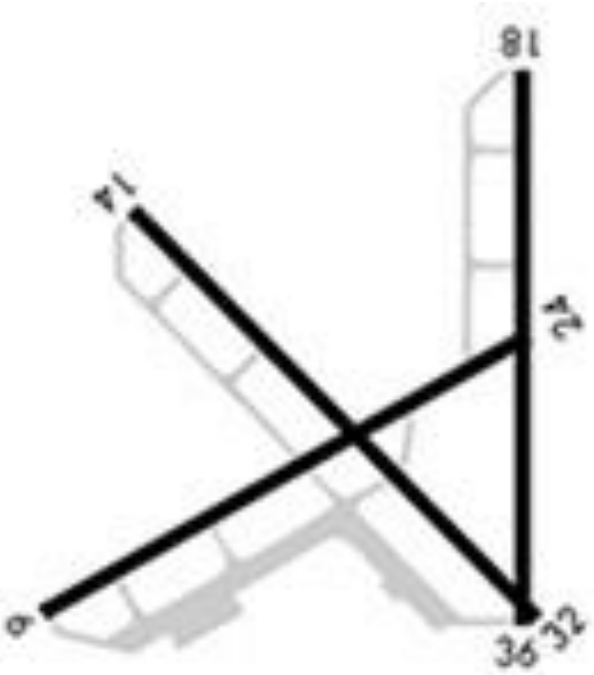
2: The distance between degrees of latitude is:
A) 1 Statute Mile
B) 1 Nautical Mile
C) Varies

3: Using the diagram below, which number indicates the BASE leg of the approach to the runway?
A) 1
B) 2
C) 3
D) 4



4: Using the same chart, which is the Final Approach?
A) 1
B) 2
C) 3
D) 4

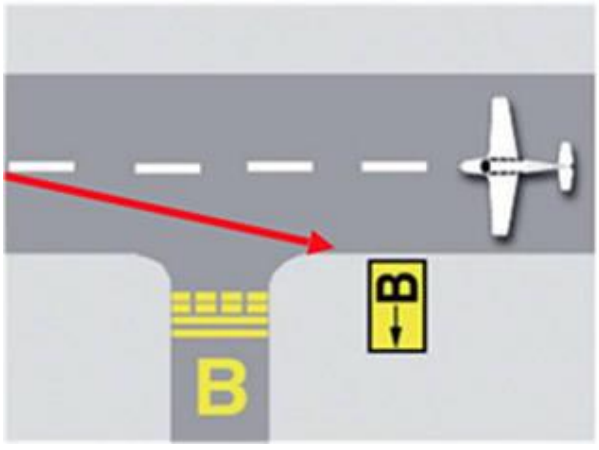
5: An aircraft announces "Midfield downwind of runway 15″. Assume a left pattern, where is the aircraft?



A) East
B) South
C) West
D) North

6: If the wind is from the north, which runway will be designated as “active”?
A) Runway 18
B) Runway 32
C) Runway 36
D) Runway 24

7: The yellow sign indicates:



A) The planes is on Taxiway B
B) An intersection with Taxiway B
C) The runway exit.

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