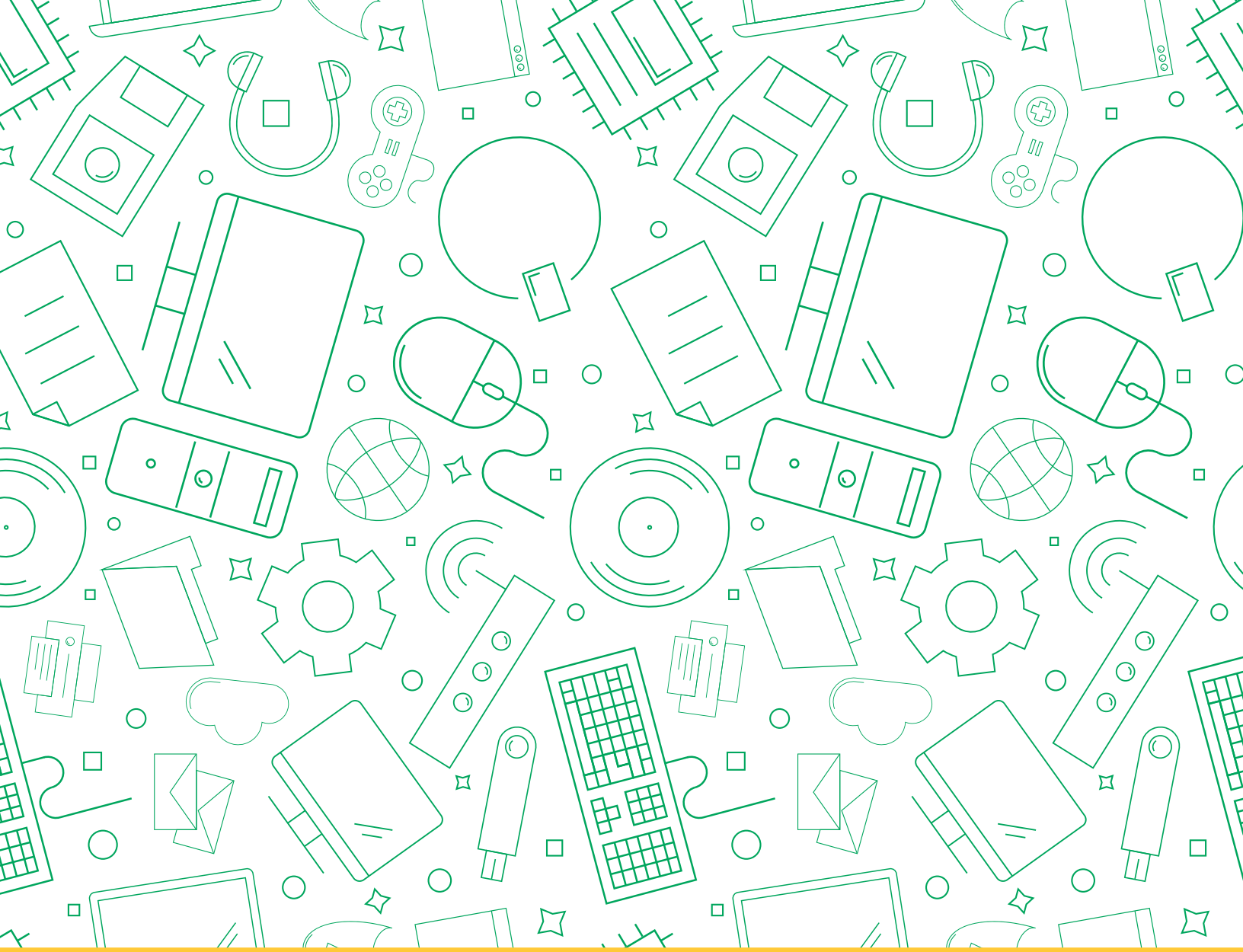

4HTECH CHANGEMAKERS

CURRICULUM TITLE:

BECOMING A RECREATIONAL DRONE PILOT

FACILITATOR GUIDE

BECOMING A RECREATIONAL DRONE PILOT
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Overview

Welcome, 4-H Tech Changemaker Facilitator! We are delighted to see your enthusiasm for undertaking the exciting venture of remote drone piloting and imparting the Drone Curriculum to adults in your local community. Our course is specifically crafted to furnish you with the requisite knowledge and abilities to instruct participants in drone-flying rules and skills suited for recreational use.

As a 4-H Tech Changemaker facilitator, you will initially undergo training in the Drone Curriculum and subsequently achieve TRUST Certification, which qualifies you as a recreational pilot. Once certified, your role will extend to conducting Drone Workshops for adults in your community, assisting them in acquiring the TRUST Certification and developing their drone operating skills.

The overarching aim of this course is to motivate adults to secure their TRUST Certification, a Federal Aviation Administration (FAA) prerequisite for recreational drone pilots. It also lays a solid foundation for those sincerely eager to advance to the next training stage, the Part 107 license, enabling pilots to operate drones commercially. Please note, however, that this program does not include instruction for obtaining the Part 107 license.

As 4-H Tech Changemakers, your journey will begin with understanding and then teaching the distinction between recreational and commercial drone flights. Next, you will explore potential career paths available to commercial drone pilots, which your students may wish to pursue should they choose to pursue their Part 107 license from the FAA.

As part of the classroom experience, you will share essential regulations guiding flying drones as part of the national airspace, learn to distinguish between controlled and uncontrolled airspace and comprehend the regulations for flying within controlled airspace. This includes learning the steps for filing a Low Altitude Authorization and Notification Capability (LAANC) request with the FAA, allowing a recreational drone pilot to request flight authorization in controlled airspace.

Furthermore, you will learn about and teach essential drone registration requirements. You will gain a comprehensive understanding of pre-flight preparations, including the consideration of weather and environmental conditions and the necessary pre-flight checks for both pilot and drone.

The course will culminate with a focus on the TRUST test, a crucial certification for recreational drone pilots. Upon course completion, 4-H Tech Changemakers will be equipped to earn their own TRUST certificate, and there will be opportunities to put your newfound knowledge into practice, initially through a simulator, then in actual flight. Consequently, you will be adequately prepared to impart this knowledge during your drone workshops.

Once again, welcome aboard, and thank you for embracing this unique challenge of becoming a 4-H Tech Changemaker and educating adults in your community about the Drone Curriculum. Now, let's prepare for our thrilling journey into the world of drone flying!

Target Audience

The target audience for this course consists of adult learners interested in learning the fundamentals of drone piloting for recreational purposes. These individuals may come from various backgrounds and professions but share a common passion for exploring the world of drones. This course is tailored to those new to the drone industry or seeking to expand their knowledge. Participants may aspire to become commercial drone pilots or are hobbyists seeking a deeper understanding of drone regulations, safety protocols, and flight techniques. The course aims to provide a comprehensive foundation in drone piloting, ensuring that all participants leave with the skills and confidence to operate their drones under the rules for recreational flyers.

Objectives

At the completion of the session, learners will be able to:

- Explain the difference between recreational and non-recreational drone flights.
- Recall the rules for recreational flying in the national airspace.
- Demonstrate how to determine if a planned flight is in controlled or uncontrolled airspace.
- Recall how to file a Low Altitude Authorization and Notification Capability (LAANC) request to obtain authorization to fly in controlled airspace.
- Explain when registering a drone is required and the process for doing so.
- Illustrate how weather and environmental factors affect drone use.
- Make use of a preflight checklist to ensure the safety of the remote pilot, aircrew, and, general public.
- Using a simulator, demonstrate the flight controls for a drone's:
  - **Ascent:** To increase the altitude of the drone. Ascent is controlled by moving the controller's left stick upward and is achieved by applying more power to the motors.
  - **Descent:** To decrease the altitude of the drone. Decent is controlled by moving the left stick in a downward direction. This is achieved by reducing the power to the motors.
  - **Pitch:** movement along the drone's lateral axis, resulting in the drone's nose moving upward or downward. With the nose of the drone away from the pilot, pitching the drone forward will result in the drone moving away from the pilot. The pitch is controlled by the right stick on the controller being moved up or down.
  - **Roll:** movement along the longitudinal axis, resulting in the drone moving left or right in relation to the nose. When rolling the drone, the left or right arms of the drone will tilt, resulting in a movement in that direction. If the nose of the drone is away from the pilot, a roll to the left will move the drone to the left. Some altitude will be lost as the total lift provided by the motors is less efficient when not level. Pilots will often apply more power by pushing the left stick forward to compensate for the lost altitude. Roll is controlled by moving the right stick of the controller to the left or right.
  - **Yaw:** Rotation of the drone about the vertical axis resulting in the nose of the drone moving left or right. No altitude is lost during a normal yaw maneuver. A yaw changes the drone's direction and, therefore the direction of the controls. Typically a drone is flown with the nose facing away from the pilot. When the pilot yaws, it changes the orientation of the drone in relation to the pilot. For example, if a pilot yaws the drone 180 degrees so that the front of the drone faces the pilot, moving the right stick forward will fly the drone toward the pilot instead of away. Yaw is controlled by moving the left stick to the left or right. It is typical for beginning pilots to use pitch and roll to control their drones so that the nose of the drone will remain pointing away from the pilot. Once a pilot gains more experience, yaw can be used to increase control of the drone. For instance, if you need to keep your drone's camera pointed at a subject while you fly a circle around them, you would use yaw to achieve that shot.
- Demonstrate the following maneuvers using a small quad-copter drone:
  - **Stable hover:** take off, ascend to 3 feet and hold, ascend to 6 feet and hold, and land.
  - **Out-and-back:** take off, ascend to 6 feet, fly straight out to a cone, hover for 5 seconds, return, and land.
  - **Simple Four Corners:** Lift off to 6 feet, fly to each of four cones laid out in a square, using pitch and roll, return to the take-off point, and land.
  - **Drone Selfie:** Lift off, hover at 6 feet, use the yaw controls to face the drone toward the remote pilot, and take a picture. Land, unload the onboard microSD card, and download the image.

Activity Outline

For each learner to have hands-on time, the class will be divided into two groups, with some students moving to the flight line for simulator and hands-on drone flights while the rest remain in the classroom. There are 5-minute transition periods for breaking the class into two groups and swapping the groups at the halfway point.

Day Before Class

- Flight batteries and controllers for drones should be charged.

High-level Schedule and Time Requirement (2-1/2 hours)

- Introductions-All learners (10 minutes)
- Transition to groups-(classroom group and flight line group) (5 minutes)
- Content Block-classroom group (1 hour)
- Swap groups (5 minutes)
- Content Block-flight line group (1 hour)
- Closure (10 minutes)

Detailed Schedule and Time Requirement (2-1/2 hours)

Introduction to Course, Instructors, and Agenda (10 minutes)

- The class will gather in the classroom for an overview of the day's agenda and to meet the facilitators.
- Learners will break into two groups. One group moves to the flight line while the other stays in the classroom.

Break into classroom group and flight line group (5 minutes)

- 4 students in each group.

Classroom Group Schedule (1-hour)

- Presentation of Slides (35 minutes)
- The TRUST Exam (25 minutes)

Swap Groups (5 minutes)

Flight Line Group Schedule (1-hour)

Each adult (2-students) (depending on the number of laptops and drones) will perform multiple roles during the flight line portion of the training. The following roles will have at least 2-adults (students) participating in each:

- Simulator ilot (10-minutes)
- Simulator observer (10-minutes)
- Drone Pilot (20-minutes)
- Visual Observer (20-minutes)

Material Need for Classroom Group and Flight Line Group

Classroom Materials

- Computer with PowerPoint
- Projector
- Color Laser Printer
- Students will need a device capable of accessing the Internet to take the TRUST exam.

Simulator/Flight Line Materials

- DJI Mini 3 with DJI RC Remote (Fly More Combo)
- DJI 30W USB Type-C Charger
- Ruggard DLP-44 44" Drone Landing Pad
- SanDisk 256GB Extreme UHS-I microSDXC Memory Card with SD Adapter
- Dell 14" Latitude 5430 Laptop (Wi-Fi Only)
- Surge Protected Power Strip 10-foot cable
- RealFlight Evolution with Controller
- PeerBasics Safety Vest
- 2-foot Folding Table
- Safety Cones

Assessment

Knowledge

Learners will take the TRUST exam, which is correctable to 100%. The Recreational Unmanned Aircraft Systems (UAS) Safety Test, or TRUST, aims to increase awareness of safety and best practices in the national airspace. The FAA requires that all recreational UAS pilots in the United States complete TRUST. A TRUST Certificate by the FAA will be provided upon completion of the exam.

Skills

- Using a simulator, learners will demonstrate proficiency in standard flight maneuvers, including take-off, hover, yaw, pitch, roll, and landing.
- Using a small quad-copter, learners will demonstrate a set of flight exercises, including stable hover, out-and-back, and simple four corners, that they can use after the course to build experience.

SLIDE 1: Becoming a Recreational Drone Pilot

Items to cover:

- Introduction of facilitators
- Logistics for the site (restroom locations, emergency exits, flight line location, simulator location)
- Breaking into two groups
- Introduce that there will be two groups - the classroom group and the flight line group.
- The flight line group will use the simulators and fly the drones first.
- The classroom group will learn about flying recreationally and earn their TRUST certificates.
- Have the flight line group go with that facilitator.

SLIDE 2: Recreational vs. Non-Recreational Flight

- A person flying purely for fun, not in support of any business operation (whether paid or unpaid) flys under the rules for recreational flight.
- If you're doing work with your aircraft, even if it's fun, you are required to obtain your Part 107 license.
- Whether flying recreationally or commercially, you must have an FAA-issued certificate for the type of flying you plan to do.

Items to cover:

- Have the students introduce themselves and indicate their experience level with flying drones.
- Define recreational vs non-recreational flight.

Define the difference between flying a drone recreationally vs. commercially.

A person who flies a drone purely for fun, and not as part of any business operation (paid or unpaid), is considered to be flying recreationally. Recreational flyers must adhere to specific rules and regulations the Federal Aviation Administration (FAA) set forth.

If a person is using their drone for any work, even if it's done as a hobby, they must obtain a **Part 107** license. This license is required for any drone flights that are considered to be commercial operations.

It is important to note that commercial operations are not limited to just businesses or corporations. Even individuals using drones to make money or gain any sort of benefit must obtain the Part 107 license. This includes photographers using drones to take aerial photos for clients, real estate agents using drones to create virtual home tours, and farmers using drones to survey crops or livestock.

The Part 107 license is issued by the Federal Aviation Administration (FAA) and requires passing a written exam covering airspace regulations, weather, emergency procedures, and drone operation. After obtaining the license, drone pilots must also follow strict guidelines for drone operation, such as flying below 400 feet and maintaining a visual line of sight with the drone at all times.

Regardless of whether a person is flying recreationally or commercially, they must have an FAA-issued certificate for the flying they plan to do. For recreational pilots, this is the FAA TRUST certificate, which students will complete in class.

SLIDES 3-4: Potential Careers for Commercial Drone Pilots

With the rapid advancement of drone technology, commercial usage has expanded beyond just hobbyist use. This has opened up many professional opportunities for commercial drone pilots. From aerial photography to disaster response, from Infrastructure inspection to smart agriculture, the different industries using drones to do their work are growing daily.

Aerial Cinematographer

Flying a drone in support of aerial photography and videography.

Real estate agencies, event planning companies, marketing and advertising agencies, film and television production companies

Infrastructure Inspection

Inspecting bridges, roads, railways, pipelines, water towers, and power lines, helping identify potential issues and improve maintenance efficiency.

Utility companies (electric, gas, water), transportation agencies (roads, bridges, railways, telecommunication companies, and specialized inspection service providers

Surveying and Mapping

Land surveying, topographic mapping, and 3D modeling for construction, agriculture, and environmental monitoring.

Engineering and construction firms, land surveying companies, GIS service providers, environmental consulting firms, and mining companies

Agricultural Management

Monitoring crop health, soil conditions, irrigation systems, yield estimation, and livestock monitoring.

Agribusinesses, large-scale farms, agricultural consulting firms, crop insurance providers, and agri-tech startups

Emergency Services

Assist in search and rescue operations by providing aerial surveillance and locating missing persons or stranded individuals.

Government agencies (local, state, or federal), emergency response teams, non-profit organizations, and specialized search and rescue service providers

Wildlife Conservation

Monitor wildlife populations, track endangered species, and identify potential threats such as poaching or habitat destruction.

Governmental wildlife agencies, non-profit conservation organizations, environmental research institutions, and ecological consulting firms.

News Reporting

Media organizations can capture aerial footage of breaking news events, providing unique perspectives and enhancing storytelling.

Television networks, local news stations, online media outlets, and independent news production companies

Public Safety and Law Enforcement

Traffic management, crowd control, and crime scene investigations

Local and state police departments, fire departments, homeland security agencies, and specialized public safety consulting firms

SLIDE 5: Preparing for Recreational Flying

Get the TRUST Certificate

If you are flying recreationally, you must have a TRUST certificate

Register Your Drone

Register your drone that exceeds 55 pounds / 250 g with the FAA before flying

Fly Safely

Know the rules for flying recreationally

By following these rules, you can ensure that you are flying your drone safely and responsibly in the National Airspace.

Items to cover:

- This is an overview slide for what will be covered during the course.
- Students will take the TRUST training and earn their certificate, allowing them to fly recreationally in the national airspace.
- Students will learn which drones must be registered with the FAA before flight. Students will learn to understand the rules for flying as a recreational drone pilot.

SLIDES 6-13: THE EIGHT RULES FOR FLYING RECREATIONALLY

SLIDE 6: The aircraft is flown strictly for recreational purposes

RULE 1

The aircraft is flown strictly for recreational purposes.

A recreational drone pilot is flying a drone for fun rather than for business purposes.

Recreational pilots are subject to different rules and regulations than commercial pilots operating under Part 107.

Part 107 refers to the Federal Aviation Administration's (FAA) regulations for operating commercial drones. These regulations require pilots to obtain a remote pilot certificate and follow specific rules for drone operation. If you receive any compensation for flying your drone, it is a commercial flight and requires you to have the Part 107 certificate.

Give the following examples and see if students understand the difference between recreational flights and commercial ones requiring the Part 107 certification.

- A friend invites you over to their house to fly your drone. You take pictures of the house and the surrounding area. You post the pictures to your social media for other friends to see. (Likely recreational)
- A friend of yours is a real estate agent and asks you to take a few aerial shots of a property they will be listing. They offer to buy you dinner at the conclusion of the flight. (Compensation doesn't just mean cash. This is a commercial flight requiring a Part 107 certificate)
- You record a video flying over a desert area and set it to music, which you post to YouTube. (Depends. If your channel is monetized, it is a commercial flight)

SLIDE 7: Flying within Visual Line of Site (VLOS)

RULE 2

The aircraft is flown within the visual line of sight of the person operating the airraft or a visual observer co-located and in direct communication with the operator.

According to the Federal Aviation Administration (FAA), recreational drone pilots are required to fly their aircraft within visual line of sight (VLOS). This means that the drone should remain within the visual range of the person operating the aircraft, or a visual observer who is colocated and in direct communication with the operator. The FAA defines VLOS as "the unaided (except for corrective lenses) visual observation of the aircraft sufficient to maintain control of the aircraft, know its location, and be able to scan the airspace in which it is operating to see and avoid other aircraft or objects." This means that drone pilots should always be able to see their drone and be aware of its surroundings to ensure safe and responsible operation.

If using a Visual Observer, they must be close enough to the pilot to communicate without the use of technology.

Although not specifically covered in the rules for recreational flying, you can't operate a drone from a moving vehicle in order to keep it in VLOS.

SLIDE 8: Flying during daylight hours

RULE 3

The aircraft is flown during daylight hours.

Another rule for recreational drone pilots is that the aircraft must only be flown during daylight hours. The FAA defines daylight hours as the period of time beginning 30 minutes before official sunrise and ending 30 minutes after official sunset. This is to ensure that pilots can see the drone and its surroundings clearly and avoid any potential hazards.

SLIDE 9: Give way to manned aircraft

RULE 4

The drone is operated in a manner that does not interfere with and gives way to any manned aircraft.

Recreational drone pilots must operate their aircraft in a manner that does not interfere with and gives way to any manned aircraft. This means that if a manned aircraft is in the area where the drone is flying, the drone pilot must yield the right of way to the manned aircraft. Additionally, recreational drone pilots should always remain alert and aware of their surroundings to avoid any potential conflicts with manned aircraft.

This rule is critical for ensuring the safety of both the drone and the manned aircraft. Recreational drone pilots should be aware that even though they are flying a small unmanned aircraft, they are sharing the airspace with other much larger and more powerful aircraft. As such, drone pilots should always watch for any manned aircraft in the area and take appropriate action to avoid potential conflicts.

When in doubt, land the drone safely and wait for the manned aircraft to clear the airspace.

SLIDE 10: Do not fly higher than 400 feet AGL

RULE 5

The aircraft does not fly higher than 400 feet above ground level.

An important rule for recreational drone flying is that the aircraft must not fly higher than 400 feet above ground level, often abbreviated as AGL. This altitude limit is set by the Federal Aviation Administration (FAA) to ensure the safety of manned aircraft, as well as people and property on the ground.

When flying your drone, you should always be aware of your drone's altitude and ensure that it remains below 400 feet AGL. Many drones come with built-in altitude

limiters, which can be set to ensure you do not accidentally exceed this height. If your drone does not have this feature, you should monitor its altitude using the controller's display or a mobile app connected to the drone.

Keep in mind that the 400 feet AGL rule is based on the ground level directly beneath the drone, rather than a fixed altitude above sea level. In hilly or mountainous terrain, the ground level may change significantly over a short distance, so it's crucial to stay aware of your drone's altitude relative to the ground beneath it.

SLIDE 11: Don't fly within five miles of an airport without prior authorization

RULE 6

The aircraft does not fly within five miles of an airport without prior autorization from the airport operator.

Another rule for recreational drone flying is to avoid flying within a five-mile radius of an airport without first obtaining authorization through the Low Altitude Authorization and Notification Capability (LAANC) system. The airspace surrounding airports is highly regulated to ensure the safety of manned aircraft during takeoffs, landings, and other flight operations.

Flying your drone too close to an airport poses a significant risk of interfering with manned aircraft, which could lead to severe accidents. To mitigate this risk, the FAA requires recreational drone pilots to obtain prior authorization using the LAANC system before flying within five miles of an airport.

LAANC provides near-real-time processing of airspace authorizations for drone pilots and offers an efficient way to comply with the rules. To obtain LAANC authorization, you can use one of the FAA-approved service providers, which are usually available as mobile apps or web-based platforms. You will need to provide details about your planned flight, such as the location, altitude, and duration. The system will assess the potential risk and determine if it is safe for you to fly in the requested area.

SLIDE 12: Flying within the safety guidelines of a community-based organization

RULE 7

The aircraft is operated in accordance with or within the programming of a community-based organization's set of safety guidelines.

There are a number of community-based organizations that have been recognized by the FAA, including the Academy of Model Aeronautics (AMA), the Drone Racing League (DRL), and the National Association of Remote Pilots (NARP). These organizations offer a variety of resources for recreational drone pilots, including training courses, safety guidelines, and insurance programs.

One important aspect of the FAA rules for recreational drone pilots is ensuring that your aircraft is operated in accordance with the safety guidelines established by recognized community-based organizations. These organizations have worked closely with the FAA to develop best practices and safety protocols for recreational drone use, which help promote a safe and enjoyable flying experience for everyone.

Some examples of community-based organizations recognized by the FAA include the Academy of Model Aeronautics (AMA), the Drone Racing League (DRL), and the National Association of Remote Pilots (NARP). These organizations offer a variety of resources for recreational drone pilots, such as training courses, safety guidelines, and insurance programs. By following the guidelines set forth by these organizations, you'll be better prepared to operate your drone safely and responsibly.

When flying your drone, it's essential to familiarize yourself with the safety guidelines provided by the community-based organization of your choice. These guidelines may cover topics like maintaining line-of-sight, avoiding no-fly zones, and adhering to altitude restrictions, as well as tips for maintaining your drone and handling emergencies.

By operating your drone within the programming of a community-based organization's set of safety guidelines, you demonstrate a commitment to responsible and safe drone operation. This helps ensure the continued enjoyment and growth of the recreational drone-flying community.

SLIDE 13: The aircraft does not fly over stadiums, parades, or other public events.

RULE 8

The aircraft does not fly over stadiums, parades, or other public events.

Flying a drone over a crowded area poses several risks, including the potential for loss of control, equipment malfunction, or collisions that could lead to injury or damage.

Additionally, unauthorized drone flights over public events can create distractions, disrupt event operations, and potentially violate privacy laws or local regulations.

To comply with this rule, always plan your drone flights away from stadiums, parades, or other public events. If you're unsure whether an area is considered a public event, err on the side of caution and choose an alternative location for your flight.

It's also crucial to stay informed about temporary flight restrictions (TFRs) that the FAA may issue for specific events, such as forest fires, major sporting events, or political gatherings. TFRs will define the restricted airspace and the time period during which the restrictions apply. You can find information about current TFRs on the FAA's website or through the B4UFly app and the ALOFT Air Control app covered later in this training.

SLIDES 14-21: Introduction To Controlled Airspace And Drones

SLIDE 14: Introduction To Controlled Airspace And Drones

- Controlled airspace refers to areas, typically surrounding airports, where air traffic control services are provided.
- Drone flight, whether professional or recreational, is regulated by the FAA.
- Recreational and Part 107-licensed drone pilots must secure authorization via the LAANC system to operate in controlled airspace.

Controlled airspace refers to areas, typically surrounding airports, where air traffic control services are provided. These areas are usually designated to ensure the safety of manned aircraft, and drone pilots need to be aware of their existence and the regulations that apply when flying in controlled airspace.

Recreational drone pilots must secure authorization via the LAANC system to operate in controlled airspace. The Low Altitude Authorization and Notification Capability (LAANC) system allows drone pilots to obtain authorization to fly in controlled airspace in near real-time. Drone pilots must submit a request through the LAANC system before flying in controlled airspace to ensure their flight is safe and legal.

SLIDE 15: Understanding Controlled Airspace

- Controlled airspace is divided into five classes, A to E.
- Class A airspace, from 18,000 to 60,000 feet, is not relevant for drones.
- Classes B, C, D, and E airspace are differentiated by airport activity levels, with B being the busiest and E filling in the gaps.

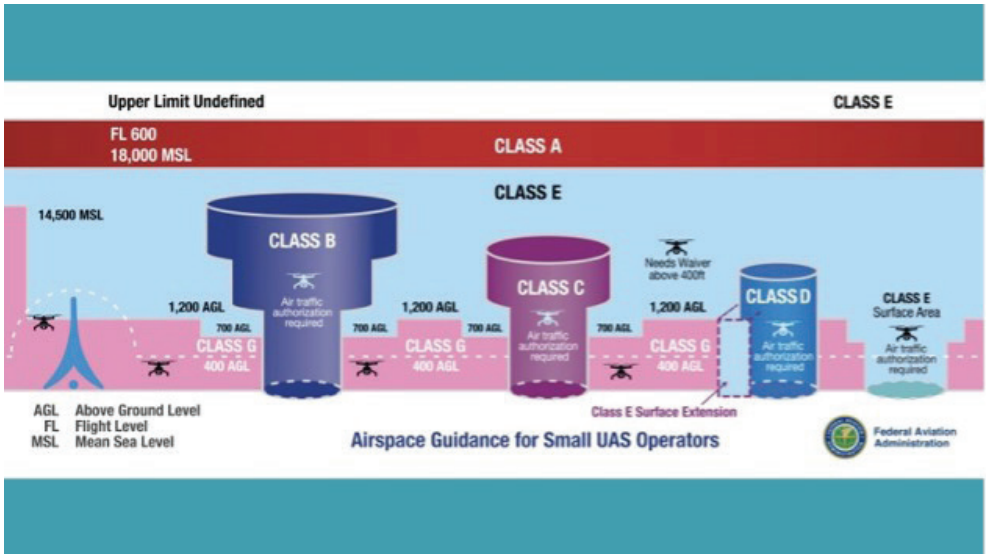
Controlled airspace is divided into five classes, A to E, with each class having its own set of rules and restrictions. Class A airspace is irrelevant for drones as it starts at 18,000 feet and goes up to 60,000 feet. On the other hand, classes B, C, D, and E airspace are more relevant to drone pilots and can be encountered while flying.

Class B airspace is usually centered around the busiest airports, and has the most restrictions for drone pilots as it is the most crowded airspace. Class C airspace is less crowded than Class B airspace but still has significant airport activity.

Class D airspace is less restrictive than Class C airspace and is typically located around smaller airports. Lastly, Class E airspace is the least restrictive of the controlled airspace classes and is used to fill in the gaps between other classes.

When flying a drone in controlled airspace, it's essential to understand the rules and regulations of the airspace class you're operating in. Check the FAA's airspace maps and read up on the specific airspace class you'll be flying in to ensure you're flying safely and legally.

SLIDE 16: Airspace Guidance For Small Unmanned Aircraft Systems (UAS) Operators



This slide covers general airspace guidance for small Unmanned Aircraft Systems (UAS) (drones).

The FAA's airspace guidance for small UAS (drones) includes the following:

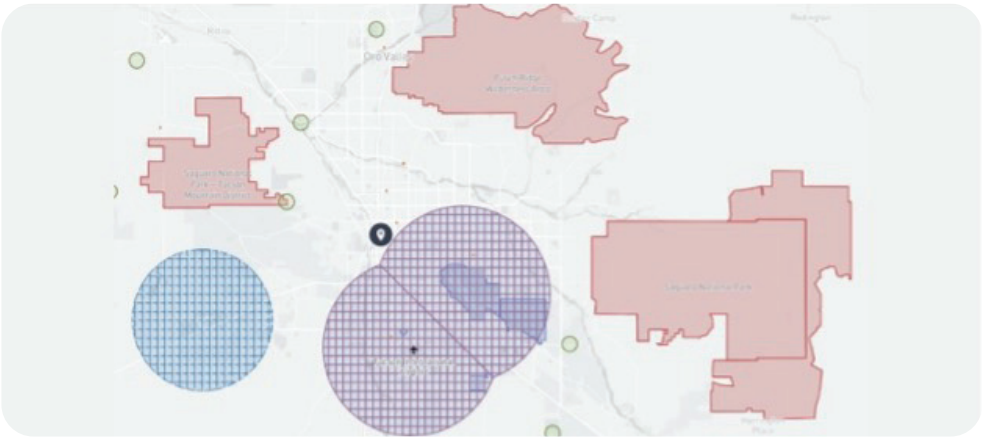
- Operate below 400 feet above ground level (AGL)
- Do not fly in controlled airspace without prior authorization.

The restricted airspace near airports is often referred to as an upside-down wedding cake. The closer you are to the airport, the more restrictive the rules are for flying. Additionally, the busier the airport, the more restrictive the rules are for flying.

Phoenix Sky-Harbor Airport is Arizona's only Class B airspace. Tucson International Airport and Davis-Monthan AFB are both Class C airports. Ryan Airfield, West of Tucson, is Class E. All of these airports have restrictions on flying drones.

Using the LAANC system, requesting and receiving permission to fly in controlled airspace is possible. The following slides will look at the airspace map around Tucson.

SLIDE 17: Identifying Controlled vs. Uncontrolled Airspace



In this slide, we are looking at the restricted airspace around Tucson, Arizona. The red areas are national parks where drone flights are forbidden.

The blue circle is the controlled air space around Ryan Airfield, and the two interconnected purple circles are the airspace around Tucson International and Davis-Monthan AFB.

Even though these are restricted airspaces, it is possible to request and be granted permission to fly drones in some of these areas.

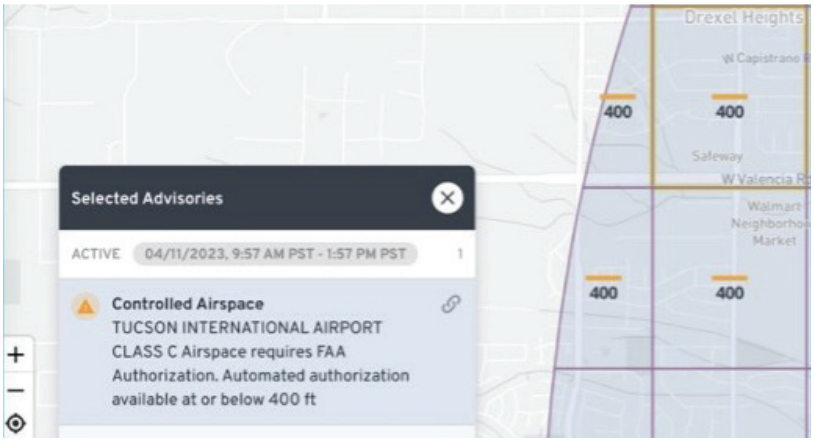
The rule of thumb is that the closer you are to the airport, the less likely you will be granted permission to fly. This is to ensure the safety of flight operations by manned aircraft as they take off and land at the airports.

SLIDE 18: Rules on Flying in Controlled Airspace

This is a close-up of the airspace around Tucson International Airport. Note that the automated flight authorization is for zero feet nearest the airport. As you move farther away, especially to the west and east of the airport, where flight operations are less frequent, you can request authorization to fly to 100, 200, and sometimes 400 feet.

Remember that 400 feet AGL is the maximum altitude for a drone flying under the rules for recreational flight.

SLIDE 19: Introduction To LAANC



Using a mobile app, you can see if you are in controlled airspace and what, if any, LAANC authorizations might be available.

In this example, in the sliver of space north of Valencia Rd, a LAANC authorization is possible to fly up to 400 feet AGL.

The B4UFLY app, often recommended on the FAA site, will show you if you are standing in restricted airspace and any temporary flight restrictions (TFRs) that might exist but cannot submit LAANC requests. Another app, covered in the following slides, will allow you to file a LAANC request.

- The FAA launched the Low Altitude Authorization and Notification Capability (LAANC) in 2017 to streamline airspace authorization.
- LAANC allows drone pilots to request airspace authorization via an app, centralizing requests and saving ATC facilities' time and resources.

LAANC stands for Low Altitude Authorization and Notification Capability. It's a system developed by the Federal Aviation Administration (FAA) in partnership with private

industry to help drone pilots access controlled airspace more efficiently and safely.

Before LAANC, if a drone pilot wanted to fly in controlled airspace, they had to manually apply for authorization from the FAA, a process that could take weeks or even months. This was inconvenient for drone pilots and a challenge for the FAA, which had to process each request individually.

With LAANC, the process is automated and nearly instantaneous. Drone pilots can apply for authorization through a LAANC service provider (usually via an app) and receive approval in just a few seconds. The system checks the proposed flight against multiple airspace data sources in real-time (including temporary flight restrictions, NOTAMs, etc.) and either approves the flight (if it's safe) or denies it (if it's not).

By automating the approval process, LAANC helps drone pilots get the permissions they need quickly and efficiently. It also helps maintain safety by ensuring that pilots have the most current information about airspace restrictions before they fly.

In short, LAANC is a critical tool for both drone pilots and the FAA, helping to balance the need for quick access to airspace with the importance of maintaining safety for all airspace users.

SLIDE 20: Types of Controlled Airspace

Rules on Flying in Controlled Airspace

- By default, drone flight is prohibited in controlled airspace Classes B, C, and D to avoid encounters with manned aircraft.
- With specific distance and altitude limits, authorization can be secured for drone flight in these classes.
- Class E airspace gnereally does not require authorization, except in rare cases near an airport.

Controlled airspace is a term used to describe the airspace where Air Traffic Control (ATC) has the authority to control air traffic. The classification of airspace from B to E each has specific requirements and regulations. Here's a simple explanation for each:

1. **Class B (Bravo) Airspace** is the most heavily controlled airspace, typically found around the busiest airports. The airspace is designed like an inverted wedding cake with several layers that expand outwards and upwards from the airport. This design aims to control all air traffic coming into and going out of the airport, particularly those at higher altitudes.
2. **Class C (Charlie) Airspace:** This type of airspace is found around airports with moderate air traffic. The structure is similar to Class B but covers a smaller area. It typically has a 5-mile radius from the airport and extends up to 4,000 feet. Again, to fly a drone in Class C airspace, you must obtain FAA authorization.
3. **Class D (Delta) Airspace:** Class D airspace is generally found around smaller airports with a control tower. This airspace typically extends in a 5-mile radius up to 2,500 feet above the airport. As with Class B and C, drone operations require FAA authorization.
4. **Class E (Echo) Airspace:** Class E airspace is all the controlled airspace that is not Class A, B, C, or D. This airspace is less busy but still controlled. It's typically the airspace above 1,200 feet (but sometimes can start as low as 700 feet) up to but not including 18,000 feet. Class E airspace can sometimes be found around smaller airports that don't have control towers.

Remember, regardless of the airspace, drone pilots must always follow the FAA's rules and regulations to ensure the safety of all users of the airspace.

SLIDES 21-27: REQUESTING LAANC AUTHORIZATION

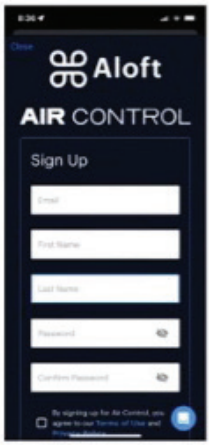
SLIDE 21: Downloading the Aloft Air Control app

Download
Aloft Air Control

Items to cover:

- The Aloft Air Control app allows recreational drone pilots to see if they are in restricted airspace, if any TFRs (temporary flight restrictions) exist, and to file a LAANC request.
- The app is available for both Android and Apple iOS.
- Give students a chance to use the QR code to visit the page where they can link to the App Store for their device.

SLIDE 22: Registering an Account



Register for an account

Items to cover:

- Signing up for Aloft Air Control is free.
- You will need to provide your name, email and create an account password.
- A verification email will be sent to the email you provide

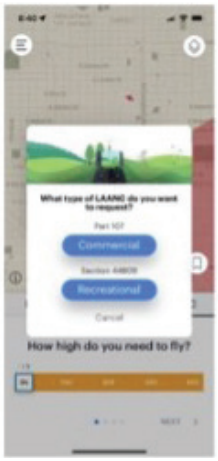
SLIDE 23: Requesting a LAANC Authorization

Select the LAANC tab and choose the area of operations and altitude for your request

Items to cover:

- We are going to cover all the steps to file a LAANC request EXCEPT for actually sending the request to the FAA.
- In step one, we select the LAANC tab in the app.
- Draw a box around our flight area before selecting a maximum altitude to fly. Select the smallest area to fly that meets the needs of the mission.
- The altitude in green shows what can be automatically processed by the LAANC system.
- Choose an altitude that meets the needs of the mission. Rarely is it needed to fly all the way to 400 feet AGL, even if the authorization is available.

SLIDE 24: Selecting the type of request



Choose Recreational for your type of LAANC request

Items to cover:

- Since this class covers the information for Recreational Flyers, we will select Recreational for our request type.
- Remind students following along on their devices that we won't submit the request to the FAA and not to jump ahead.

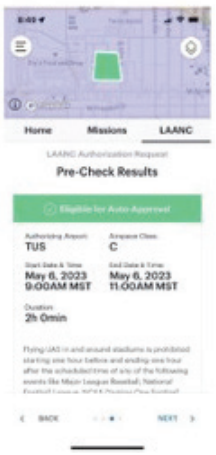
SLIDE 25: Select the Day and Time

Set the time and date for your flight

Items to cover:

- Here we select the date and time for our flight to start. It is possible to file LAANC requests in advance but often recreational pilots will be standing where and when they want to fly. The automated system will usually process requests in less than a minute.
- Pilots shouldn't show up where they want to fly and launch the app for the first time. Part of flight planning is to check the app in advance to know if you are in controlled airspace or if there is an active TFR that would prevent you from flying.

SLIDE 26: Confirming your details



Confirm the details on your flight

Items to cover:

- This is the chance for the pilot to confirm their entered details.
- Make sure the location, start date and time, and flight duration are all correct.
- The next step after this is what would submit the request to the FAA. Remind students that we are not actually filing a request and NOT to submit to the FAA.
- You might even recommend that they watch the next step and cancel the work they have done so far.

SLIDE 27: Submitted your LAANC Request

Submit your request to the FAA

DO NOT DO THIS STEP IN CLASS!

Items to cover:

- DO NOT SUBMIT THIS REQUEST TO THE FAA
- This is the last step before submitting; responses are usually just seconds away.
- If the pilot has limited the size of their flight area and the altitude, the authorization will likely come back approved within moments.

SLIDES 28-33: DRONE REGISTRATION REQUIREMENTS

SLIDE 28: Weight requirements for registration

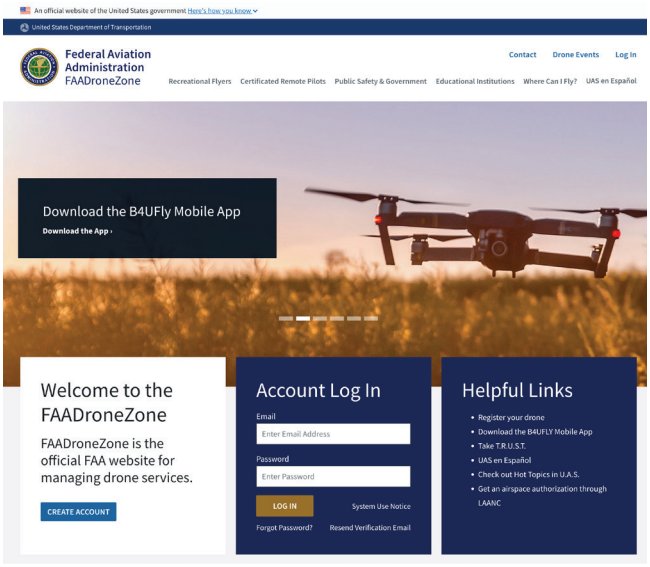
If your drone is under .55 pounds (250g) AND you are flying under recreational flyer rules, you do not have to register your drone.

The DJI Mini 3 we will be flying weighs 248g with the standard battery.

Items to cover:

- Drones at or over 250g (0.55 pounds) must be registered with the FAA
- Fun fact: 0.55 pounds is about the weight of two sticks of butter.
- The drones we have selected for this course weigh in at 248g with the standard battery. The advanced battery available for this drone makes the drone over the weight limit.
- When weighing the drone, it must have the battery, propellers, and any other equipment that will be flown as part of the measurement.

SLIDE 29: Intro to FAA DroneZone



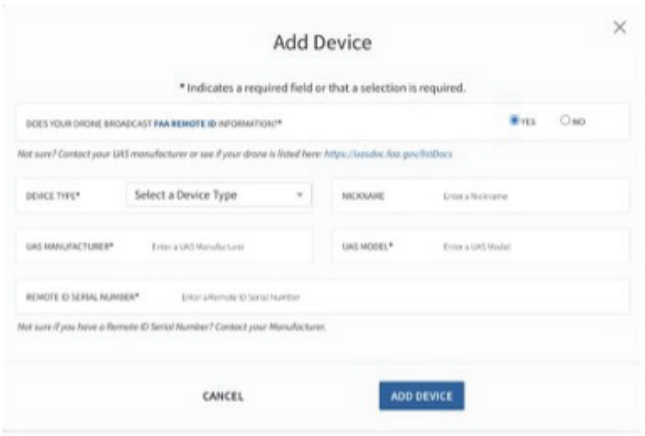
FAA DroneZone

https://faadronezone-access.faa.gov/

Items to cover:

- Registering a drone begins at the FAA DroneZone website.
- You must create an account, which is free.
- Part 107 pilots must register each drone in their fleet, but recreational pilots can use a single registration number for all the drones they own.

SLIDE 30: Adding a device



Need to know

- Remote ID Capable?
- Manufacturer
- Model
- Remote ID Serial -OR- Serial Number of Drone

Items to cover:

- Beginning in September 2023, drones weighing more than 250g will require REMOTE ID.
- **Remote ID** is a system that allows the identification and tracking of drones from a distance using a digital identifier broadcast by the drone. We will cover it more in the next slide.
- When you register your drone, you will need to indicate if the drone has Remote ID capabilities.

You will also need to know:

- The drone manufacturer
- The model of the drone
- The serial number of the drone (or the Remote ID Serial number)

Note: UAS stands for Unmanned Aerial System. It is the drone, the ground control station, and the accessories that make up the drone system.

SLIDE 31: What is Remote ID?

What is Remote ID?

Remote ID helps the FAA, law enforcement, and other federal agencies find the control station when a drone appears to be flying in an unsafe manner or where it is not allowed to fly.

Remote ID also lays the foundation of the safety and security groundwork needed for more complex drone operations.

Items to cover:

- Remote ID is a system installed on a drone to broadcast location and owner information so that the FAA and law enforcement can trace a drone to its owner.
- Recreational drone pilots are required to show their TRUST certificate and drone registration information at the request of law enforcement.
- If you are flying in restricted airspace, you may also have to show your LAANC authorization

SLIDE 32: Is Remote ID Required?

Is Remote ID Required?

All drone pilots required to register their UAS must operate their aircraft in accordance with the final rule on remote ID beginning **September 16, 2023**, which gives drone owners sufficient time to upgrade their aircraft.

If your drone isn't Remote ID capable, it can still be flown at an established FAA-Recognized Identification Area (FRIA).

Items to cover:

- The requirement for Remote ID is currently scheduled to begin on Sept 16, 2023.
- If a drone isn't capable of remote ID, you must fly in an established FRIA
  - A FRIA, or Fixed Remote Identification Area, is a designated area where recreational drone pilots can fly their drones without remote ID capabilities.
  - We have not been able to find a FRIA in southern Arizona.

SLIDE 33: Drone Registration Summary

Summary

- Registration is required for drones weighing 250g or more
- Drones will require Remote IF beginning September 2023
- One registration number can be used for all drones owned by a single pilot if flown under the ruler for recreational flyers
- Drones must be marked on the outside with a registration number.
- There is a $5 fee to register

Items to cover:

- Recap when a drone is required to be registered and the information that must be submitted.
- For pilots flying under the rules for recreational flying, one registration number can be used across all the pilot's drones.
- The registration number must be displayed on the outside of the drone.
- There is a $5 to register a drone, and the registration is valid for three years.

SLIDES 34-37: Preparing to Fly

SLIDE 34: Preparing to Fly: Weather and Surroundings

High winds, low visibility, or turbulence can make your drone hard to control

Cloud cover or sun angle can make the drone hard to see

Avoid flying near trees, power lines, buildings, or people

Avoid distractions while flying. Be ready to ground should a manned aircraft appear.

Items to cover:

- Some drones can only fly indoors because even a light wind makes them uncontrollable.
- The drone recommended for this course is capable of flying in 10.3 m/s (23 mph) winds.
- Dust or precipitation leading to low visibility are also environmental factors that can cause concern.
    - » Most drones should not be flown in the rain. Check the manufacturer's recommendation before taking flight.
- Flying near tall buildings or hills can result in losing control due to air turbulence. This is especially true on warm days.
- Seeing a grey drone against a grey sky is hard! Make sure your flight area allows you to maintain VLOS.
- Avoid flying near obstacles. Turbulence can be unpredictable, and flying near buildings or people is dangerous.
- Avoid areas with a lot of other air traffic. Be ready to ground if you see a manned aircraft in your flight area.

SLIDE 35: Preparing to Fly: Check Yourself

Ensure you are physically and mentally ready to operate the drone safely. Sickness, stress, and medications can affect your ability to fly safely and respond to unplanned situations.

Recreational drone flyers need to be aware of how conditions like stress, fatigue, and dehydration, can affect their flying abilities.

Alcohol and drugs (including over-the-counter medication) can have a detrimental effect on the decision-making and hand-eye coordination needed to fly your drone safely.

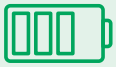
Items to cover:

- Introduce IMSAFE.
  - » IMSAFE is an acronym that stands for Illness, Medication, Stress, Alcohol, Fatigue, and Emotion. Drone pilots use this acronym to help them assess their fitness for flying and determine if any conditions might impair their ability to operate a drone safely.

SLIDE 36: Preparing to Fly: Check Your Drone

Check all parts of the drone for signs of damage or wear

- propellers/rotor blades
- landing gear
- structure



Check the battery strength and condition

- Do not fly if the battery has nicks in the casing or bulging sides
- Damaged batteries can cause fires
- Do not fly with low battery power as many drones have been lost because they crashed after losing battery power

Check the control station

- Make sure you have the most current software updates, good command and control signal strength, and adequate Global Positioning Satellite (GPS) coverage.

Items to cover:

Perform a pre-flight checklist to make sure the drone is safe to fly:

- Check the drone's battery level and make sure it is fully charged. Verify that the propellers are securely attached and not damaged. Inspect the drone's body for any cracks or other damage.
- Make sure the drone's GPS signal is strong and stable.
- Turn on the drone and check that all its systems are functioning correctly, including the camera (if applicable).
- Verify that the control station is functioning correctly and is fully charged. Check the weather conditions to ensure safe flying conditions.
- Verify that the area you plan to fly in is free of any obstacles or hazards, such as trees, power lines, or buildings.
- Make sure that you have the necessary permits and licenses to fly your drone in your chosen location.

Post-flight checklist:

- Inspect the drone's body for any damage that may have occurred during the flight. Check the propellers for any signs of wear or damage.
- Verify that the drone's battery is undamaged, especially if there was a hard landing. Looks for nicks or bulging of the battery pack.
- Check the control station for any damage or issues and ensure that it is charged.
- Store the drone in a safe and secure location to protect it from damage or theft.

SLIDE 37: Take the Trust Test

Items to cover:

- It is TIME! You are ready to take the FAA TRUST test and earn your recreational pilot certificate.
- Only sites with the logo on the left are authorized to issue the TRUST certificate.
- The University of Arizona is one of those sites!
- You will need to review the material and take each of the assessments. The quiz is correctable, so don't stress!
- Be sure to print your certificate!

Simulators - Instructions for Facilitators

System Requirements

Recommended System

- Windows* 7, Windows* 8 or Windows* 10
- Dual Core 2.4GHz CPU
- 2 GB RAM
- 3D Accelerated Video with 512 MB dedicated video memory

*Administrator Access Required

Installation

Follow the manufacturer's instructions for installing the software. You must plug in the RC Controller before running the installer.

Set up

You will want to select one of the drones available in the software. It is recommended that you choose a drone that is close in capability to what the students will be flying on the flight line.

See the image below for a good drone to fly in the simulator.

Flight Line Operations - Instructions for Facilitators

The flight line group consists of four students and, at a minimum, one 4-H tech changemaker facilitator who will also act as the Flight Line Marshal (FLM). Each site is equipped with two flight simulators and two DJI drones for students to use during the training.

The first two students will begin by flying the simulators. The other two students will observe their peers. After 10 minutes, the observing students will take over the simulators, and the first two will observe. Once everyone has had a chance at the simulator, the whole group will move to the flight line. The first two pilots should put on the safety vests to visually indicate their role. The Flight Line Marshall (FLM) will also wear a vest. The students who are not flying will be visual observers, a real-world role on many flight crews. They will help their pilots by reading instructions and providing situational awareness, including the need to ground should there be nearby manned aircraft traffic. Each pilot will work through the flight maneuvers, guided by their observer. After 20 minutes, the pilots and observers will change roles (and safety vests). The new pilot should change the drone's battery before their flight.

Flight Line Marshall

One of the 4-H Tech Changemaker Facilitators will act as the Flight Line Marshall (FLM). The FLM is in overall charge of safety near the flight line while operations are in progress. Common safety concerns include cuts from handling a drone while the propellers are turning, a drone colliding with a participant while in flight, and propellers breaking or flying free during flight. By managing the flight line, the FLM can mitigate these safety concerns. The FLM will only allow participants to cross the flight line when all drones are grounded. Controllers will be placed on the flight tables and no one will handle them while pilots place or retrieve their drones from the landing pads. Once drones are on the landing pads and pilots are back beyond t for takeoff.

Checklist

Each student pilot should check their drone before the flight. Verify the following:

- With the controller on the flight table and the drone powered off, check the propellers are free moving.
- Examine the drone for damage, paying attention to any stress marks on the propellers that may indicate the need for a replacement.
- Look at the battery pack and ensure it isn't damaged or bulging.
- Power on the drone and controller and verify the link.
- Verify the drone's battery is fully charged.
- Verify the controller battery is fully charged.
- Verify the camera is functional.
- When the Flight Line Marshall (FLM) tells you it is safe, place the drone on the landing circle and step back to the flight table.
- Scan the surrounding airspace for other traffic.

Taking Off

- Verify with the FLM that you are clear to take off.
- Announce "Taking Off!" in a loud and clear voice.
- Arm the drone and perform the take-off procedure.
- Establish a stable hover.

Flight Operations

Complete the same activities from the simulator practice.

Activities

Students should learn to take off and land, hover, and fly around an object.

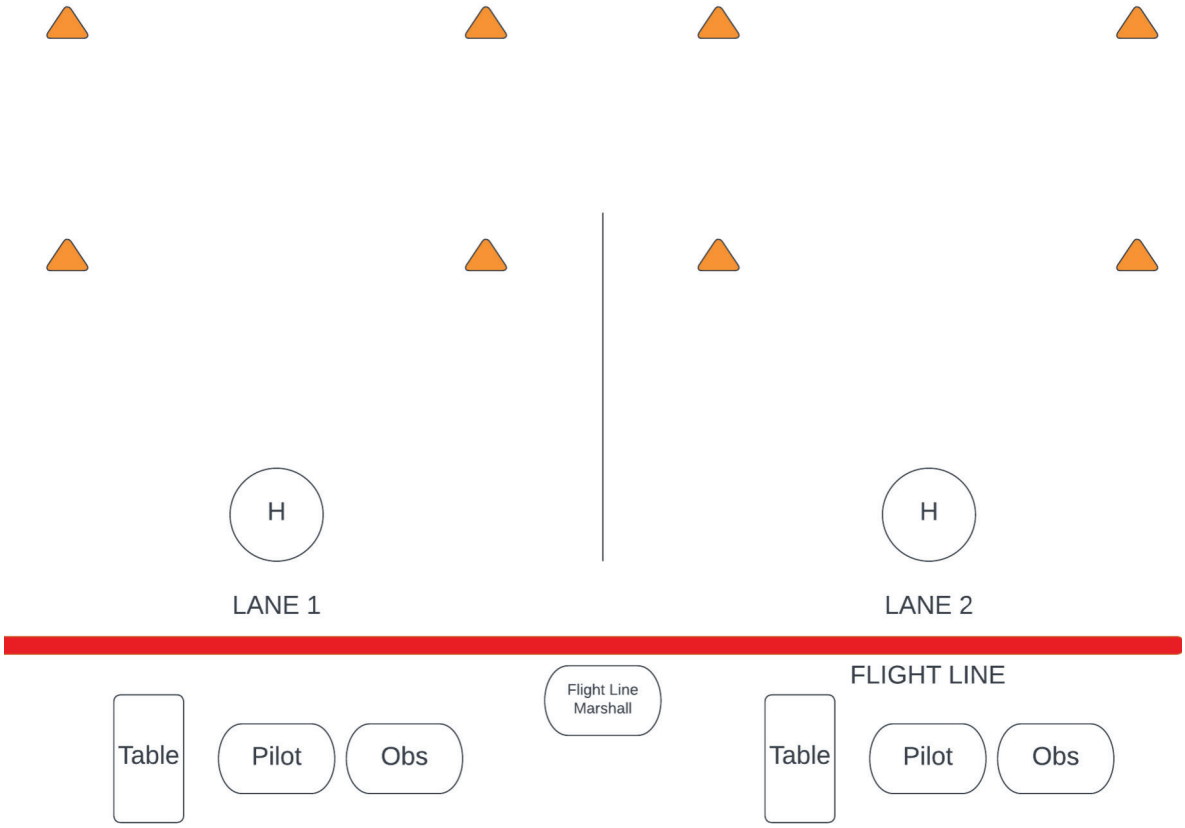
1. **Stable Hover** - Students will take off, hover at different altitudes, and land within 2 feet of the landing circle.
    a. Lift off to 3 feet
    b. Maintain a stable hover over the landing circle
    c. Increase altitude to 6 feet
    d. Hover
    e. Land.

2. **Out and Back** - Fly to one of the cones, hover, and return to the landing pad.
    a. Take off
    b. Hover at an altitude of 6 feet
    c. Fly to a cone placed 20 feet away from the landing circle
    d. Return to the landing circle.
    e. Land within 2 feet of the landing circle.

3. **Simple Four Corners** - Fly out to one of the cones and then fly around each cone in a square pattern.
    a. Lift off to 6 feet
    b. Maintain a stable hover above the landing circle.
    c. Fly to the first of four cones placed in a square at least 20 feet from the landing circle.
    d. Using only the right control stick, fly to the second cone.
    e. Repeat for each of the four cones of the square.
    f. Return to the landing circle and land.

Flight Line Diagram

The active pilots (two at a time) and the Flight Line Marshall (FLM) will wear safety vests while on the Flight Line. Each flight lane is capable of supporting one pilot and one observer at a time. The pilot will perform the pre-flight checklist while the drone and controller remain on the table. Controllers are to remain on the table, untouched, while the pilot performs their pre-flight check or someone is carrying the drone to or from the flight line. The pilot will cross the flight line and place the drone on the landing pad when the FLM says it is safe. Once all pilots are back behind the flight line, the FLM will indicate that it is safe to pick up a controller and arm the motors on the drone. Each pilot will be supported by another student in the class, acting as the observer, who will read the current maneuver's steps and help assess the pilot's success. The FLM is primarily there to ensure safety but can help pilots by answering questions and making suggestions. Both the FLM and observers should keep their attention on the whole flight area as pilots tend to lose situational awareness as they concentrate on the flight controls and focus on their drone.



Key Safety Points

- No one crosses the flight line without permission from the Flight Line Marshall (FLM).
- All controllers will be on the table, untouched, while pilots cross the flight line.
- Pilots will announce when they are taking off, e.g. "Taking off on Lane 1!" after visually verifying that the area surrounding their drone is debris free and clear of other participants.