Drone Group -[Thanksgiving Point Drone Light Show | Utah Renaissance Faire 2022]

EIU - Rural School Initiative

Drones in the Classroom

November 16, 2023

Integrating Problem Solving and Computational thinking

Sign-In

CREDIT to Illinois Learning Technology Center (LTC) for base information.

Adapted from their Drones in the Classroom program

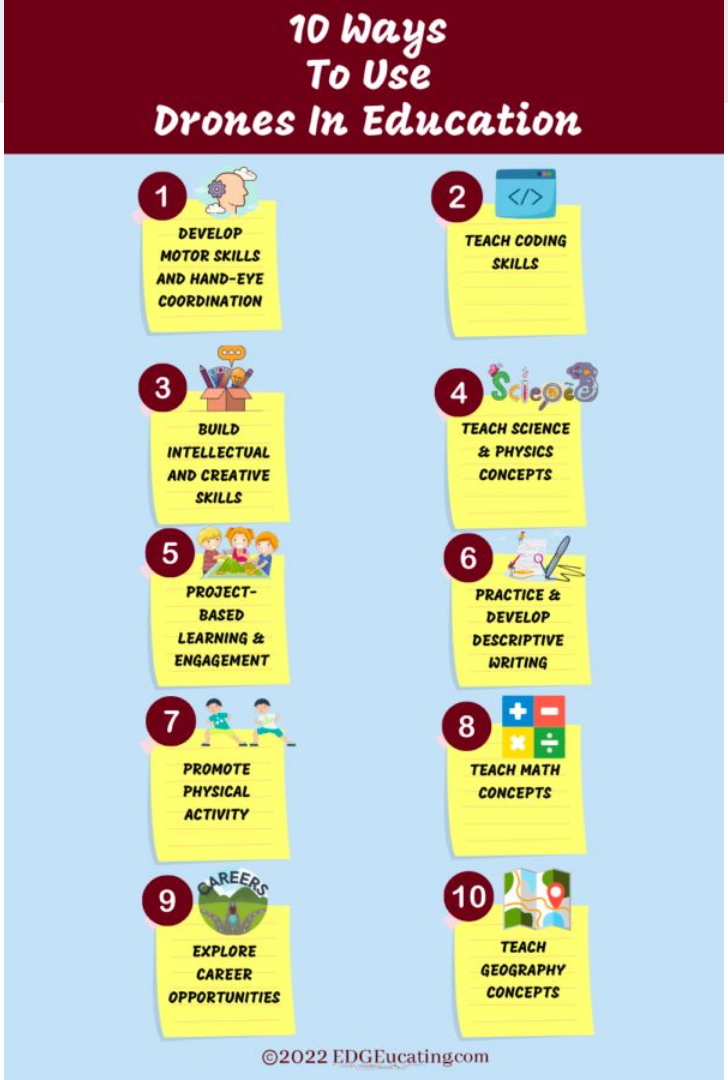
Outline for Today

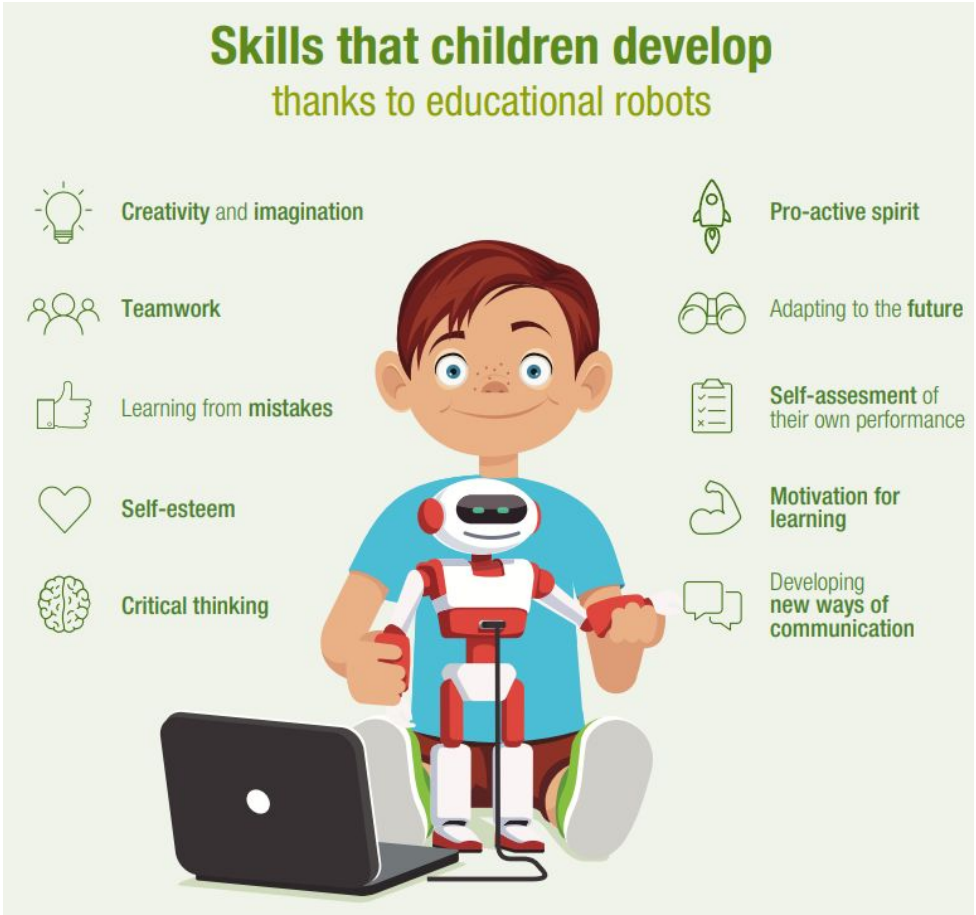
1. Unbox and explore a Tello drone
2. Explore how drones are being used currently
3. Identify drone terminology
4. Examine the rules of flying
5. Explore the TRUST safety test
6. Learn to fly the Tello
7. Explore drones in the curriculum
8. Afternoon Flying
9. Explore different drone options
10. What is Computational Thinking
11. Coding and Logic
12. Drones – robots that fly (more fun too)
    a. Flying Drones
    b. Safety and Legal Issues
    c. Coding to automate flight plan
13. Discussion - where do these fit into the curriculum?
14. Optional Next Steps

Drone basic limits

Maximum Size	250 g over that requires FAA registration costing $5 for a sticker 8.8 oz or half a pound
Maximum Height	400 ft equal to 40 stories
Restricted Airspace	Airports, Hospitals, State/National Parks, Public Events Schools unless it is a staff member and a classroom activity
Restricted Activities	Spying and invasion of privacy
Indoors	FAA's rules for drone operation do not apply to indoor flights

10 Ways To Use Drones In Education





Classroom Curriculum

Apps to Download

a. Tello App
   i. Tello App - iOS
   ii. Tello App - Android (be sure to go to the DJI site linked here as it will take you to the newest version of the app.)
b. Drone Blocks
   i. Drone Blocks - iOS
   ii. Drone Blocks - Android
   iii. Drone Blocks Chrome Extension
   iv. Drone Blocks - Apps
c. Aloft Air Control
   i. Aloft - iOS
   ii. Aloft - Android

What is a drone?

UAV - unmanned aerial vehicle

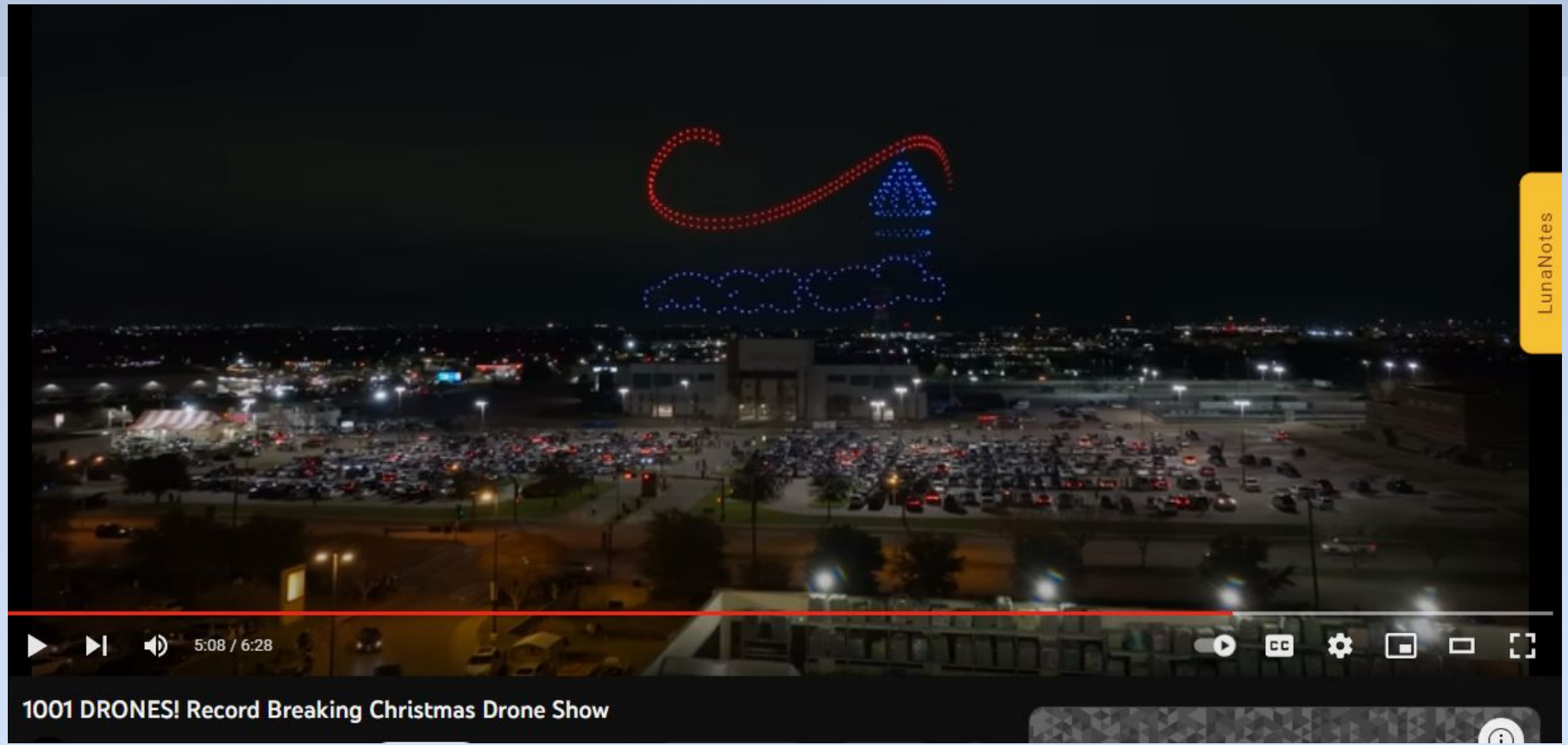
UAS - unmanned aircraft system

An unmanned aircraft system is an unmanned aircraft and the equipment necessary for the safe and efficient operation of that aircraft. An unmanned aircraft is a component of a UAS. It is defined by statute as an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft.

Uses For Drones

- Flying for fun
- Drone racing
- Aerial photography
- Forest Firefighting
- Building/Tower inspections
- Bridge inspections
- Shark spotting
- Police/Fire Department use
- Search and Rescue
- Crop inspections
  - DJI Agriculture App
- Aerial mapping
- Hospital blood/organ delivery
- Drone Delivery - Amazon and more
- List keeps GROWING

Fun and example of precision possible



[Sky Elements - Texas Christmas Show - RECORD]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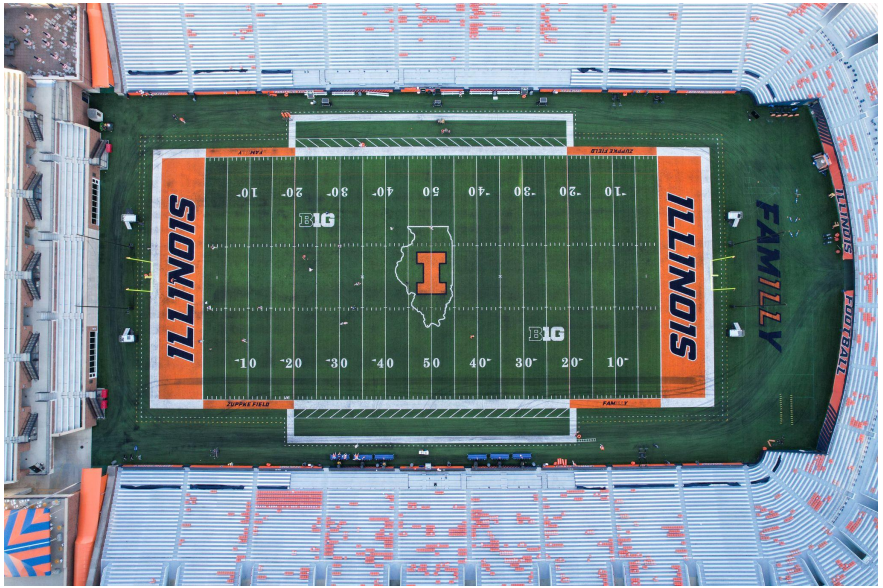
ILLINOIS
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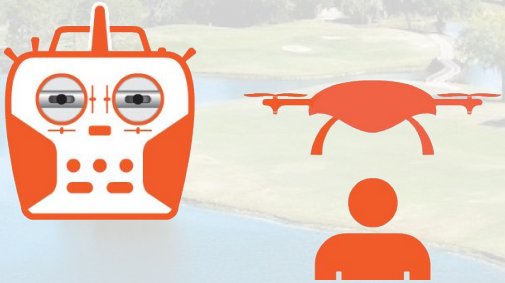
FAMILY
FOOTBALL

Drone Terminology

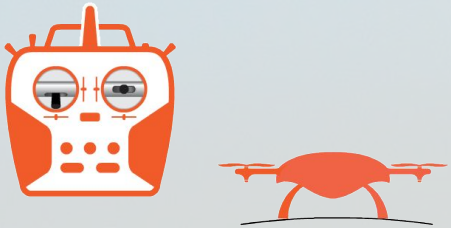
- UAV – Unmanned Aerial Vehicle
- UAS – Unmanned Aerial System
- Quadcopter – Aircraft that uses four motors and four propellers
- **PIC – Pilot In Charge* (recommend pilot in charge and spotter)**
- Transmitter (TX) -- A hand-held controller that sends a signal to the drone
- Gimbal -- A platform that can pivot on a single axis; creates a balanced, smooth movement for the camera during flight
- Autonomous Flight -- **Aircraft is self-directed and programmed** to fly independently, not physically or manually controlled
- First Person View (FPV) -- Also known as remote-person view (RPV), or simply video piloting
- Manual Flight – Transmitter is used by PIC and aircraft is **kept in line of sight**

How do drones fly?



Rotation around the front-to-back axis is called **roll**. – Right stick left or right

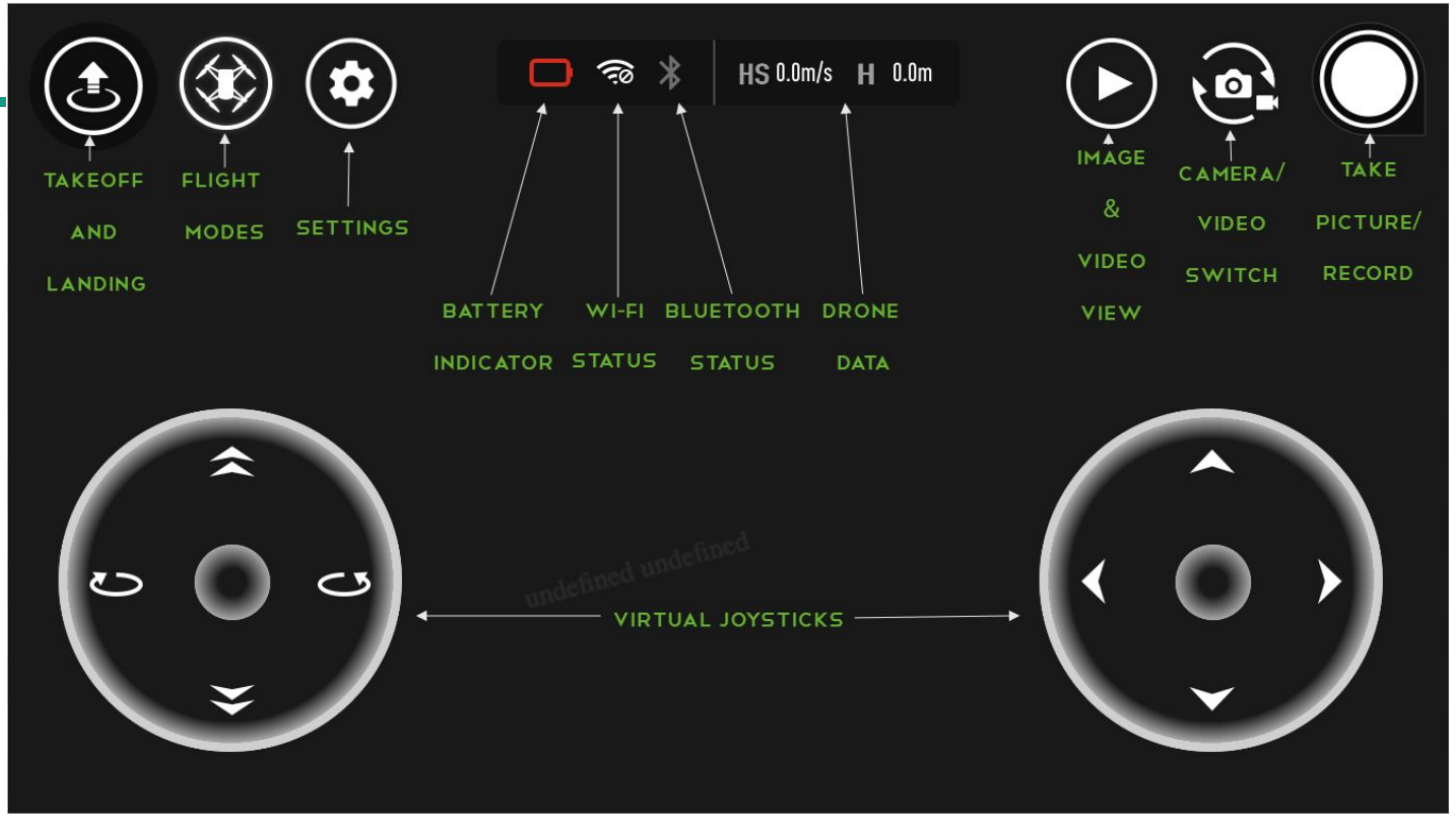
Rotation around the side-to-side axis is called **pitch**. – Right stick forward or backward



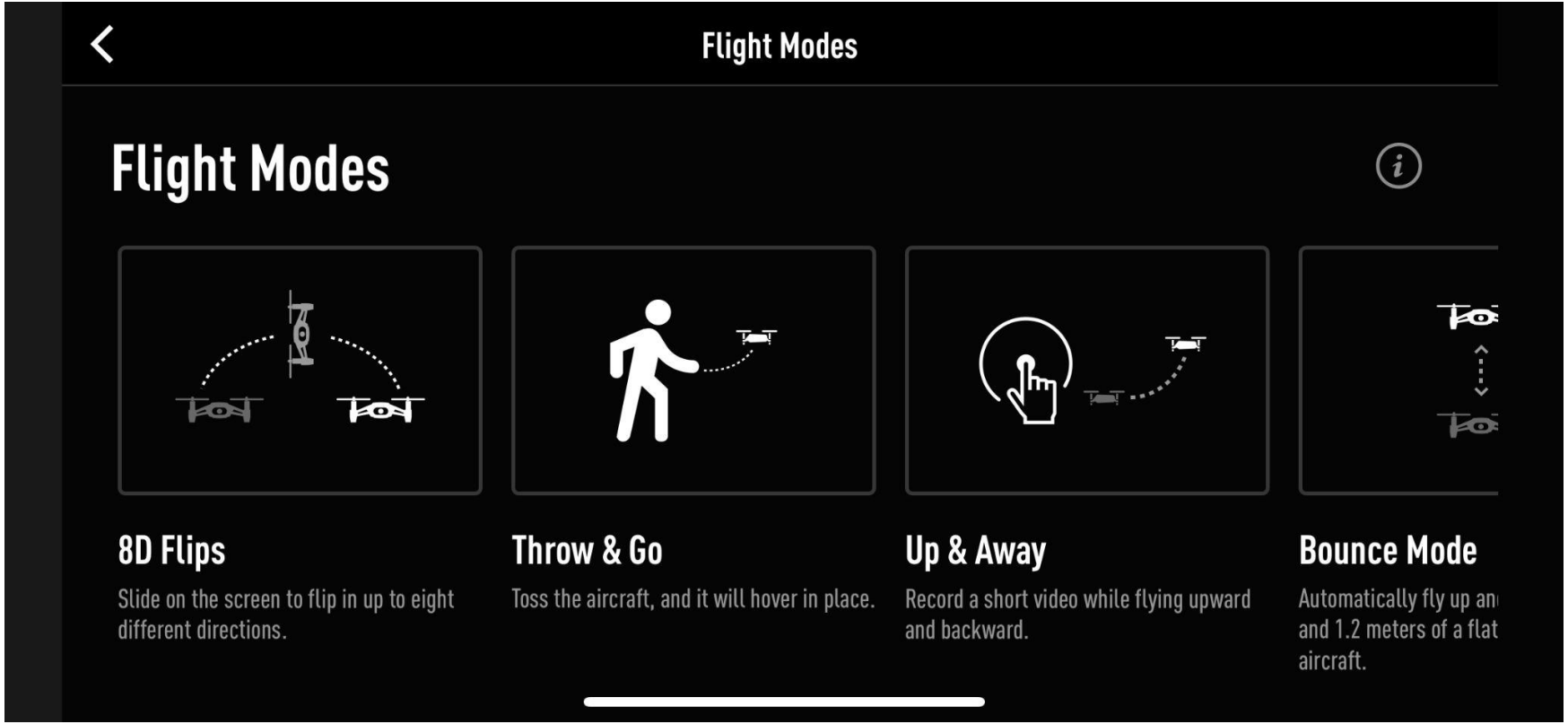
Throttle controls lift. – Left stick up and down

Rotation around the vertical axis is called **yaw**. – Left stick left or right

Flying the Tello



Tello Flight Modes



Rules for Flying

Drone Limits for small devices and education

To fly a drone as a commercial pilot in the state of Illinois you are required to follow the requirements of the FAA's Part 107 Small UAS Rule, which includes passing the FAA's Aeronautical Knowledge Test to obtain a Remote Pilot Certificate.

Drones are prohibited from flying less than 350 feet above the ground and capturing images of public schools during school hours. They are also restricted from operating in the airspace overlaying the civic center complex or a city park or beach during a scheduled special event.

Is it legal to use a drone to spy on people?

Criminal Code Section 934.50: Drones may not be used for surveillance in violation of another party's reasonable expectation of privacy; this includes law enforcement. However, police may use drones with a valid search warrant.

Education Exception - https://www.faa.gov/uas/educational_users

What are the safety guidelines for UAS recreational users?

- Follow community-based safety guidelines, as developed by organizations such as the Academy of Model Aeronautics (AMA).
- Fly no higher than 400 feet and remain below any surrounding obstacles when possible.
- Drones cannot fly faster than 100 mph
- Keep your sUAS in eyesight at all times, and use an observer to assist if needed.
- Remain well clear of and do not interfere with manned aircraft operations, and you must see and avoid other aircraft and obstacles at all times.
- Drones cannot be flown at night without appropriate lights

Recreational Safety 2

- Do not intentionally fly over unprotected persons or moving vehicles
- Use **Air Control** to confirm you can fly within range of an airport or heliport. (Read about best practices here)
- Do not fly in adverse weather conditions such as in high winds or reduced visibility.
- Do not fly under the influence of alcohol or drugs.

Full set of FAA Operating Rules

Recreational Safety 3

- Ensure the operating environment is safe and that the operator is competent and proficient in the operation of the sUAS.
- Do not fly near or over sensitive infrastructure or property such as power stations, water treatment facilities, correctional facilities, heavily traveled roadways, government facilities, etc.
- Check and follow all local laws and ordinances before flying over private property.
- Do not conduct surveillance or photograph persons in areas where there is an expectation of privacy without the individual's permission (see AMA's privacy policy).

Illinois Specific Drone Laws

ILLINOIS DRONE REGULATIONS

Federal Drone Laws in Illinois

These are drone laws that apply to every state in the U.S., including Illinois, and were created by the federal government.

To fly a drone as a commercial pilot in the state of Illinois (i.e. for work / business purposes) you are required to follow the requirements of the FAA's Part 107 Small UAS Rule (Part 107), which includes passing the FAA's Aeronautical Knowledge Test to obtain a Remote Pilot Certificate.

To fly a drone as a hobbyist in the state of Illinois (i.e. for fun / pleasure) you are required by the FAA to take The Recreational UAS Safety Test (TRUST). You are also required to follow the FAA's recreational model aircraft rules. One of those rules is that if your drone weighs more than 0.55 lbs (250g), you'll need to pay $5 to get it registered. There are additional rules when it comes to airspace and altitude, keeping your drone within line-of-sight while you're flying, and more.

To fly a drone as a government employee in the state of Illinois (i.e., for a police or fire department) you may either operate under the FAA's Part 107 rule or obtain a federal Certificate of Authorization (COA).

Note: The content on this page is meant for informational purposes only, and is not meant to take the place of legal counsel.

UAV Coach Illinois Specific Drone Laws

TRUST
The Recreational UAS Safety Test

All recreational flyers must pass an aeronautical knowledge and safety test and provide proof of test passage (the **TRUST completion certificate)** to the FAA or law enforcement upon request. The FAA's 2018 Reauthorization Bill (PDF) introduced new requirements for recreational pilots (see P.L. 115-254, Section 349 (PDF) – exception for limited recreational operations of unmanned aircraft).

Take the test through the AMA

Let’s Fly!

Get to know the Tello Talent

Hands on with Drones

GPS

Aerodynamics

Sensors to manage stable flight

Communicate using WiFi for distance

Commercial Uses of sUAS

Any commercial use in connection with a business requires a Part 107 license, including:

- Selling photos or videos taken from a UAS
- Using UAS to provide contract services, such as industrial equipment or factory inspection
- Using UAS to provide professional services, such as security or telecommunications
- Using UAS to monitor the progress of work your company is performing
- Professional real estate or wedding photography
- Professional cinematography for a film or television production
- Providing contract services for mapping or land surveys

Flying in Education

- See FAA Rules
- If flying outside, you *technically* must have your 107 license
- ***If you operate the drones indoors, you do not need the licensing***
- Students do not need their 107 to fly outdoors as they would fall under recreational and educational use
- Best practice:
  - Train/demonstrate indoors and be the observer outdoors

Become an FAA-Certified 107 Drone Pilot by Passing the Unmanned Aircraft General – Small (UAG) Test

1. To be eligible to get your Remote Pilot Certificate, you must be:
    - At least 16 years old
    - Able to read, write, speak, and understand English
    - Be in a physical and mental condition to safely fly a UAS
2. Review the full process to get your Remote Pilot Certificate.
3. Study for the Knowledge Test by reviewing the Test Prep materials provided by the FAA.
4. Schedule an appointment to take the Knowledge Test at an FAA-approved Knowledge Testing Center (PDF).
5. The test is 2 hours long and consists of 60 multiple choice questions.
6. Once you've passed your test, complete FAA Form 8710-13 for a remote pilot certificate (FAA Airman Certificate and/or Rating Application) using the electronic FAA Integrated Airman Certificate and/or Rating Application system (IACRA)*

Become an FAA-Certified 107 Drone Pilot by Passing the Knowledge Test

Drone Pilot Ground School

Everything you need to pass the test. Our course covers all 120+ knowledge concepts across 70+ video-based lectures that the FAA requires drone pilots to learn in the UAS Airman Certification Standards

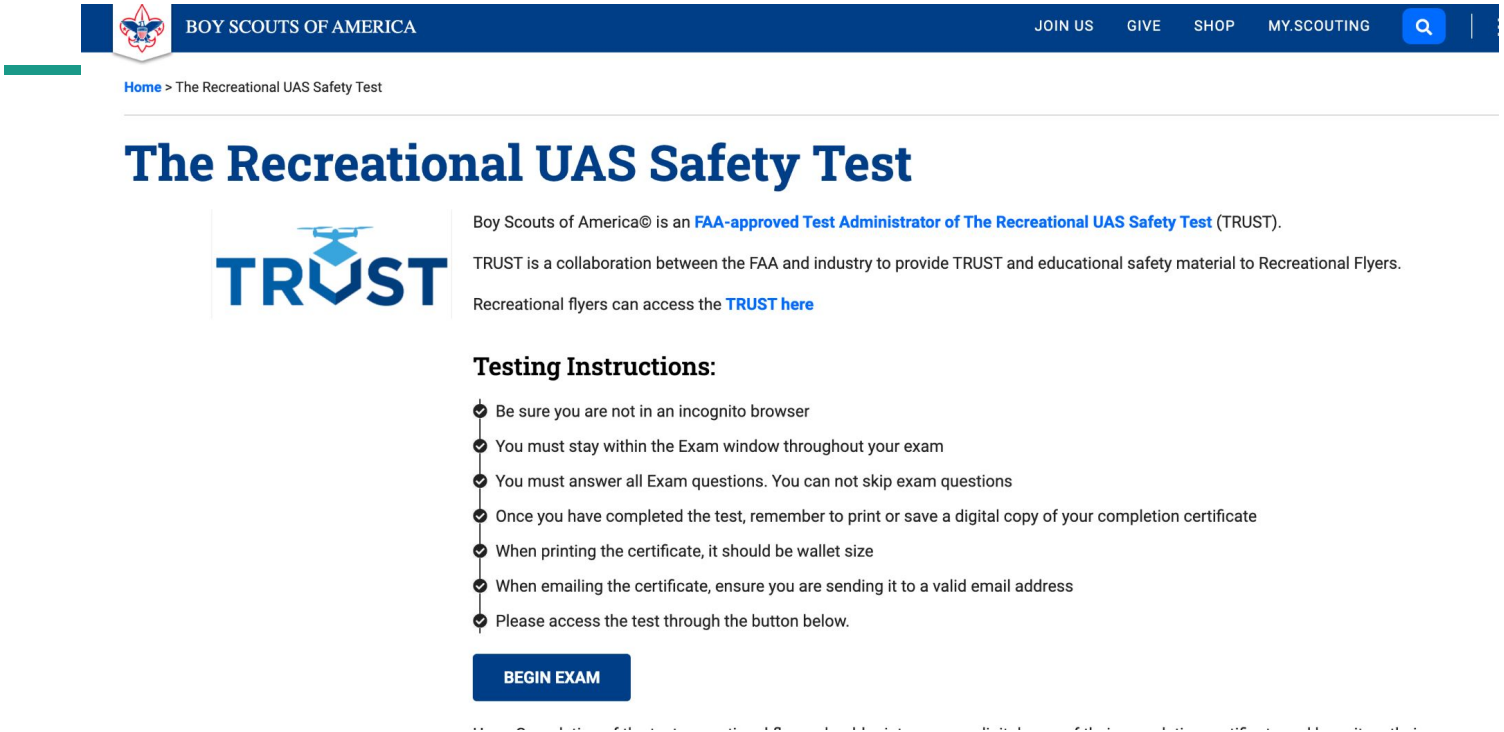
Bonus lessons with practical flight knowledge. Our flight proficiency lesson demonstrates flight sequences for the beginning sUAS operator. You also get a pre-flight checklist and guides on how to conduct airspace research and how to apply for airspace authorization and waivers.

Plus, bonus lessons on business operations. Learn from a drone lawyer and other industry professionals about how they approach important legal, marketing, insurance and business considerations.

Use this link for $100 off Drone Pilot Ground School - STEM Teacher Discount

Rules for Flying
- basic cert for teachers

Let’s take The Recreational UAS Safety Test



AMA

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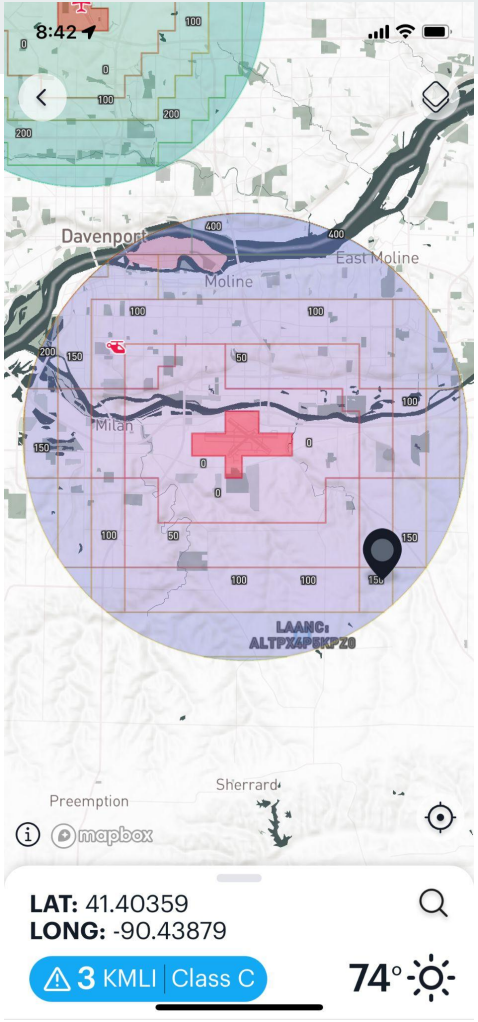
Education Guidelines

As of May 5, 2016, the use of unmanned aircraft systems by students in accredited education institutions as part of their coursework will be allowed under recreational guidelines for model aircraft, provided the aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization

The interpretation also clarifies that UAS can be operated for demonstration purposes at community-sponsored events, provided that the aircraft operator does not receive any compensation, directly or indirectly, related to the operation of the aircraft.
Students can learn how to design, construct and operate small unmanned aircraft (less than 55 pounds) as a component of a variety of science, technology and aviation-related coursework or for other educational purposes such as in connection with television, film or photography courses. These uses fall under hobby or recreational use, according to the FAA's interpretation, and schools and students should follow all the same protocols as a hobbyist.

Using **ALOFT App** to Prepare and Confirm a Flight Plan

Pulls FAA Maps, Restricted Zones , Weather, Notifications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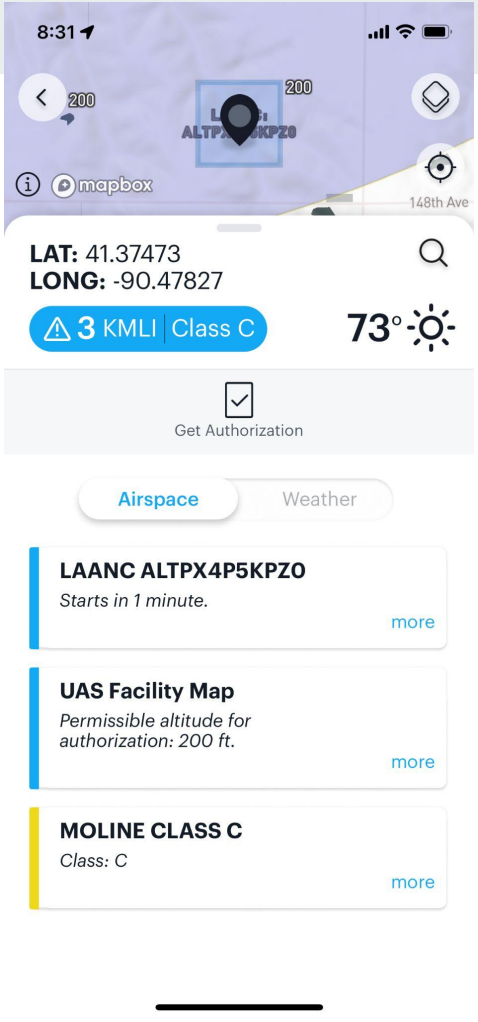
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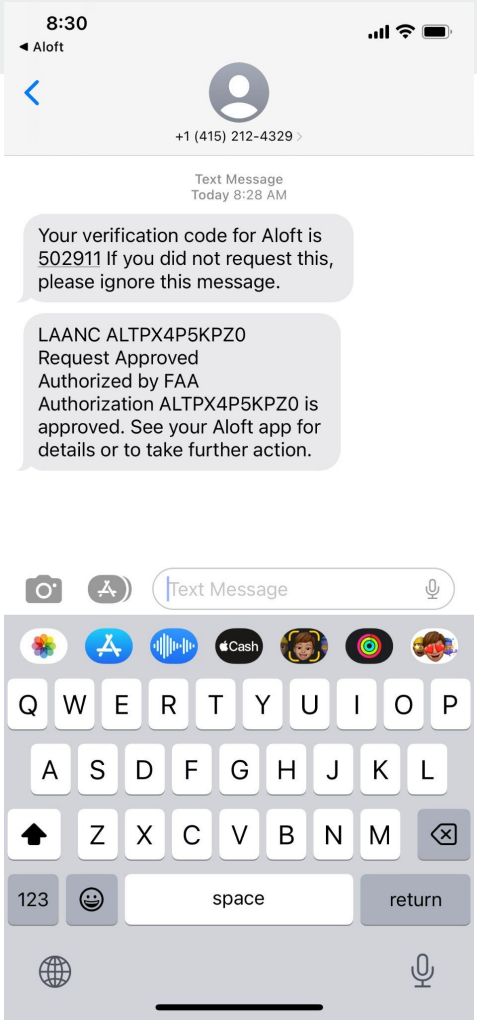
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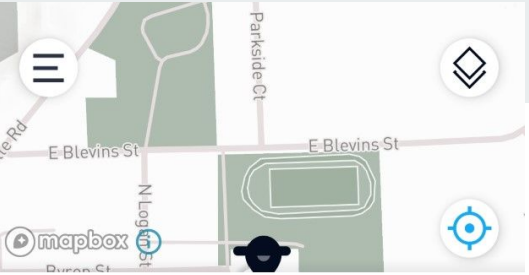

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Airspace | Weather

Summary
38°
Clear

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From E

Gusts
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Visibility
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FLY

Air Control & Weather

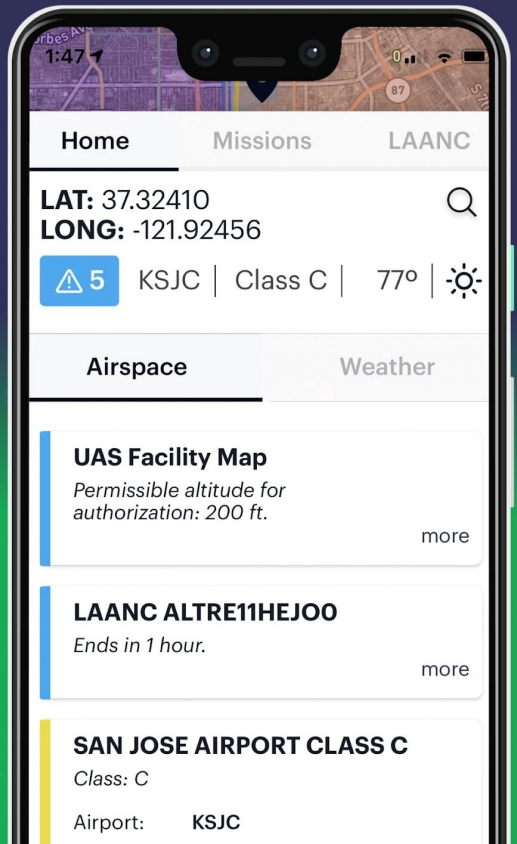
ALOFT - Air Control (app)

Air Space Restrictions

Weather Details

Nearby Sensitive Areas

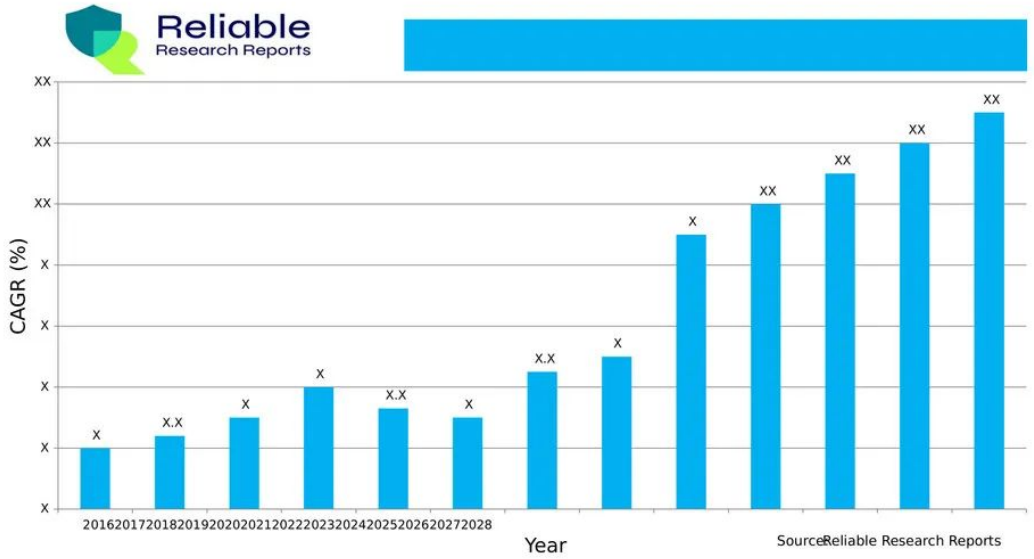
View authorizations directly from Dynamic Airspace



Drone Curriculums

- Droneblocks - Paid Curriculum
  - Droneblocks Simulator
- DJI Education Hub - Free(ish)

Drones in the Classroom History and Projection



Drones in the Classroom Resources

LTC Resources

Drones in the Classroom

For Teachers

As you or your district considers bringing drones into the curriculum, please take advantage of these curated resources.

Safety Guidelines and Certifications

- Academy of Model Aeronautics - Safety guidelines from the AMA for all drone users
- List of Drone Laws for the USA
- Educational Guidelines - Amended guidelines for Educators
- The Recreational UAS Safety Test - Test Required for all drone pilots
- FAA Certified Remote Pilot 107 Certification - Certification for commercial drone piloting
- Illinois Specfic Drone Laws

Drone Uses

- Flying for recreation
- Drone racing
- Aerial photography
- Forest Firefighting
- Building/Tower inspections
- Bridge inspections
- Shark spotting
- Police/Fire Department use
- Search and Rescue
- Crop inspections
- Aerial mapping
- Hospital blood/organ delivery

Drones in the Classroom Resources

- Drone Pilot Ground School Partners with Pleasant Valley High School to Launch Afterschool Drone Program - Drone Pilot Ground School
- Drone Pilot School Part 107 training for students - Resource
- Drones in Education - Chris Carnahan
- Teach STEM Drone Racing Curriculum
- Know Before You Fly - Online Drone Learning Resource
- AMA Flight School - Self-paced course for learning about drones
- Lesson Plans for Drones - Article
- Robotics Education Takes Flight - Article
- Drones Take Their Place in the K–12

Drone Options

Starter Drones

Ryze Tech Tello - $149.99

Hopper - $1,750 (3 Drones + Curriculum)

Racing Drones

Tinyhawk 2 - $129.99

Coding Drones

CoDrones - $215

Mid Level Drones

DJI Mini 2 - $449

DJI Mini SE - $299

High Level Drones

DJI Mavic Air 2S - $999

DJI Mavic 3 - $2,049

FAA and P-12 exemption – updated Sept 2023

https://www.faa.gov/uas/educational_users

PRACTICE App for phones or tablets/iPads - "For students who struggle with flying drones, consider outfitting them with a tablet and a simulation app like QuadcopterFx so that they can practice with that in between flight times."

"Consider having students wear safety glasses, even though drones are quite safe and flying apps have emergency features."

Simulator - DJI flight simulator

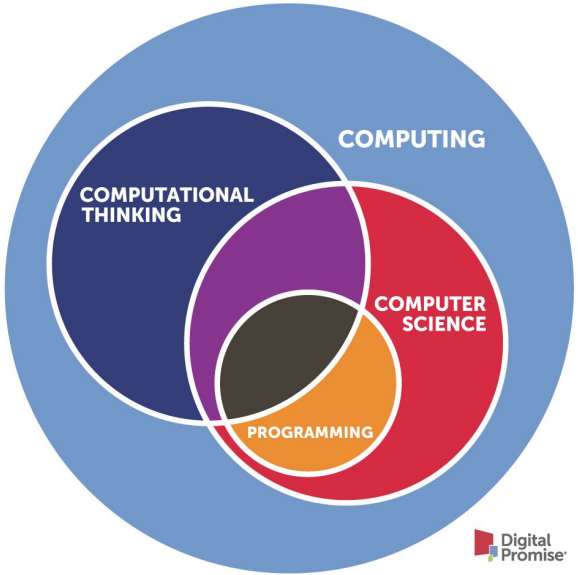
Apple App Store

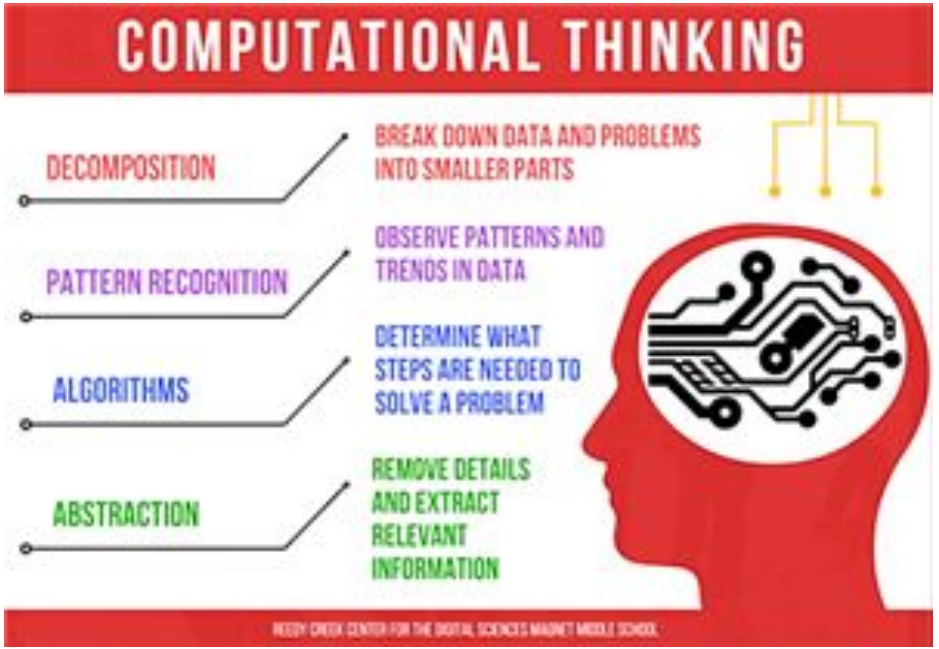
https://apps.apple.com/us/app/dji-virtual-flight/id1541992396

Android Play Store

https://play.google.com/store/apps/details?id=com.ammonite.dronesimulator&hl=en_US&gl=US&pli=1

Computational Thinking



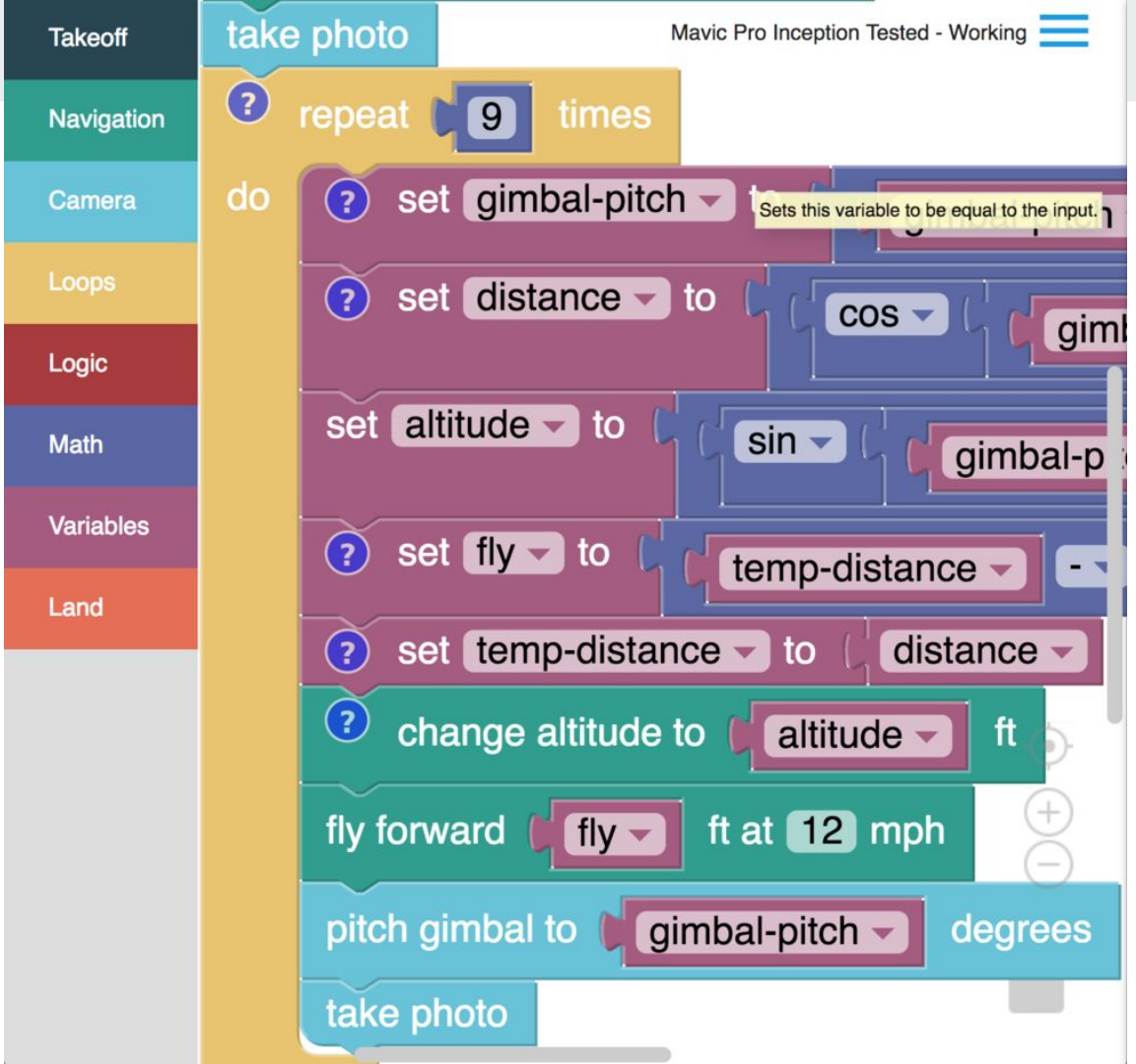


P.B.L.

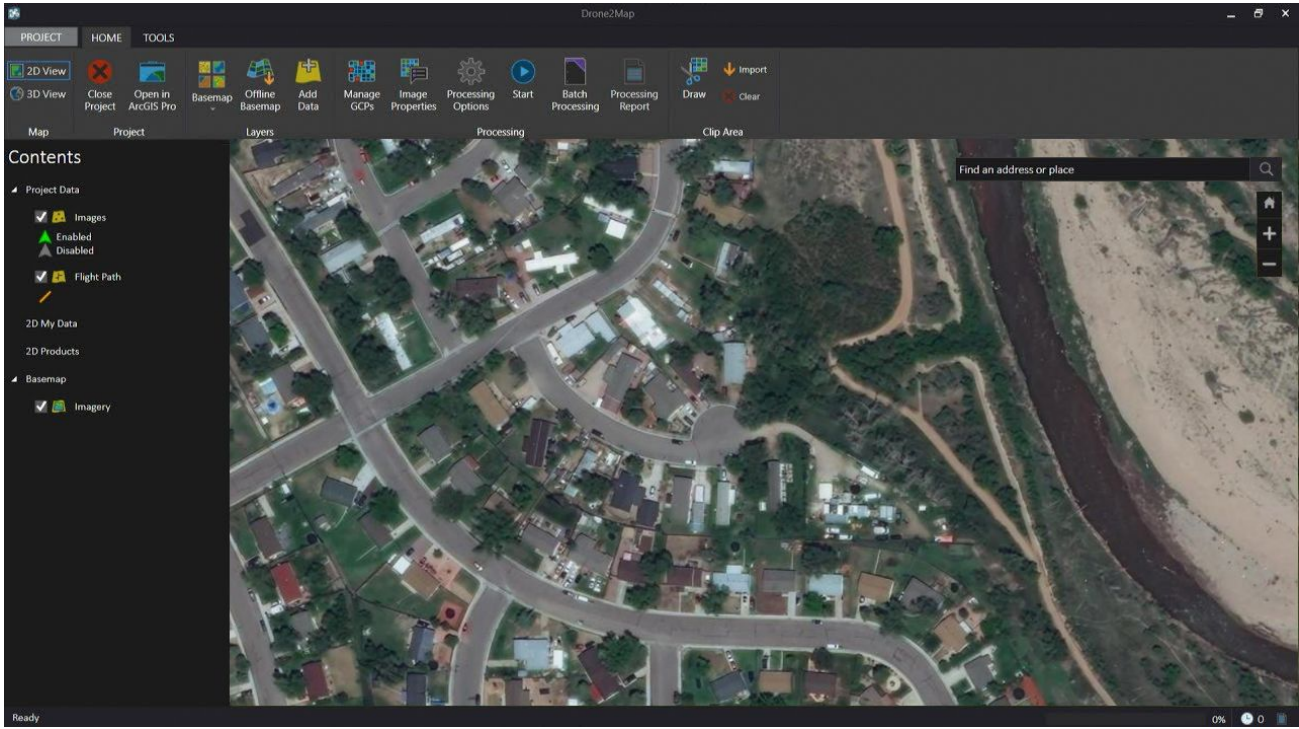
Problem Based Learning
Place Based Learning
Project Based Learning / Site Based Learning

Drone Blocks

Pre-Program the flight path



Mapping



Drone pictures save to the device where they can be used in lesson, posters, & MAPS (Perfect for Google MyMaps)

How would you use Drones with your students?

History, Geography, Geology -> MAPS

Drone Mapping

- https://yourdronereviews.com/best-free-drone-mapping-software
- https://www.suasnews.com/2022/10/skyebrowse-to-offer-free-3d-modeling/

Drones with your Students - demos and ideas

- MS Snips - https://www.youtube.com/watch?v=g3GwdvacAuc
- Drones in STEAM - https://www.youtube.com/watch?v=RqQZtjFBEgw&t=242s
  Drone legends curriculum
- DYI Drone - https://www.youtube.com/watch?v=jrFBko3k49w
- MATH integration with aviation - Kelly Remijan - https://digitalcommons.imsa.edu/pfs_pr/41/
- Green Leaf Project - https://greenleaf.unl.edu/ (drought)
- Harvard Forest Canopy Camera - https://harvardforest.fas.harvard.edu/news/harvard-forest-forest-canopy-camera-installed
  - https://harvardforest.fas.harvard.edu/webcams
- FEMC - https://www.uvm.edu/femc/data/archive/project/webcams_monitor_leaf_phenology

Q&A plus Wrap-up