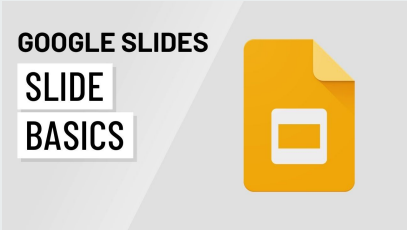
EIU - Rural School Initiative

Robots and Drones in the Classroom

October 27, 2022

Zoom Link

Integrating Problem Solving and Computational thinking



Sign-In

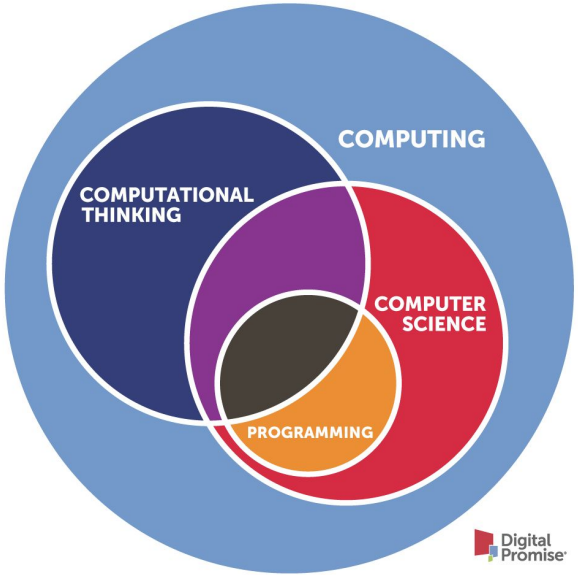
CREDIT to Illinois Learning Technology Center (LTC) for base information.

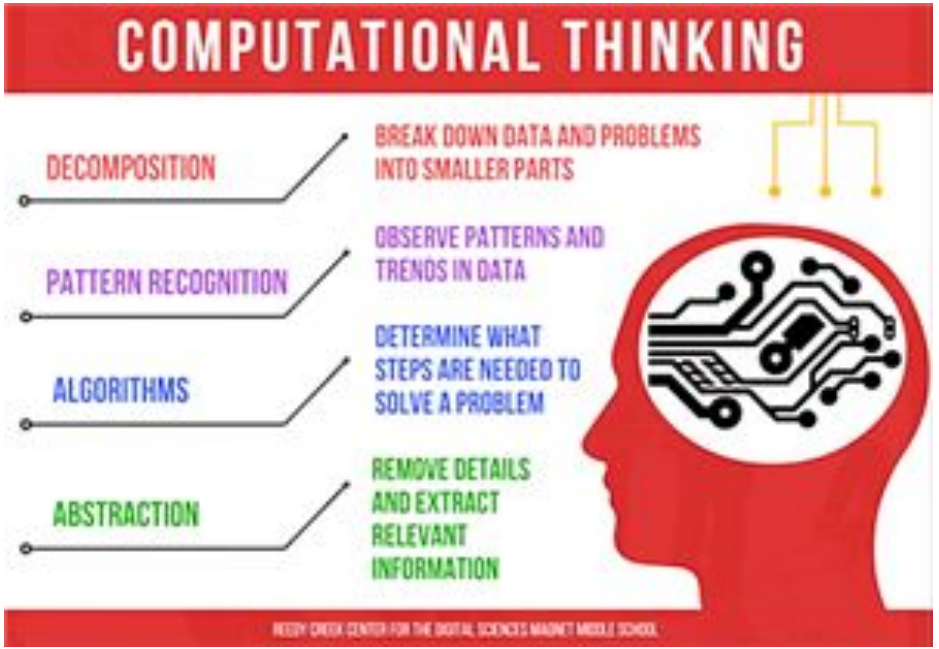
Adapted from their Drones in the Classroom program

Outline for Today

1. What is Computational Thinking
2. Coding and Logic
3. Using Robots as a hands-on coding application
    a. Try out common classroom robots
4. Drones – robots that fly (more fun too)
    a. Flying Drones
    b. Safety and Legal Issues
5. Discussion - where do these fit into the curriculum?
6. Optional Next Steps

Computational Thinking





P.B.L.

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

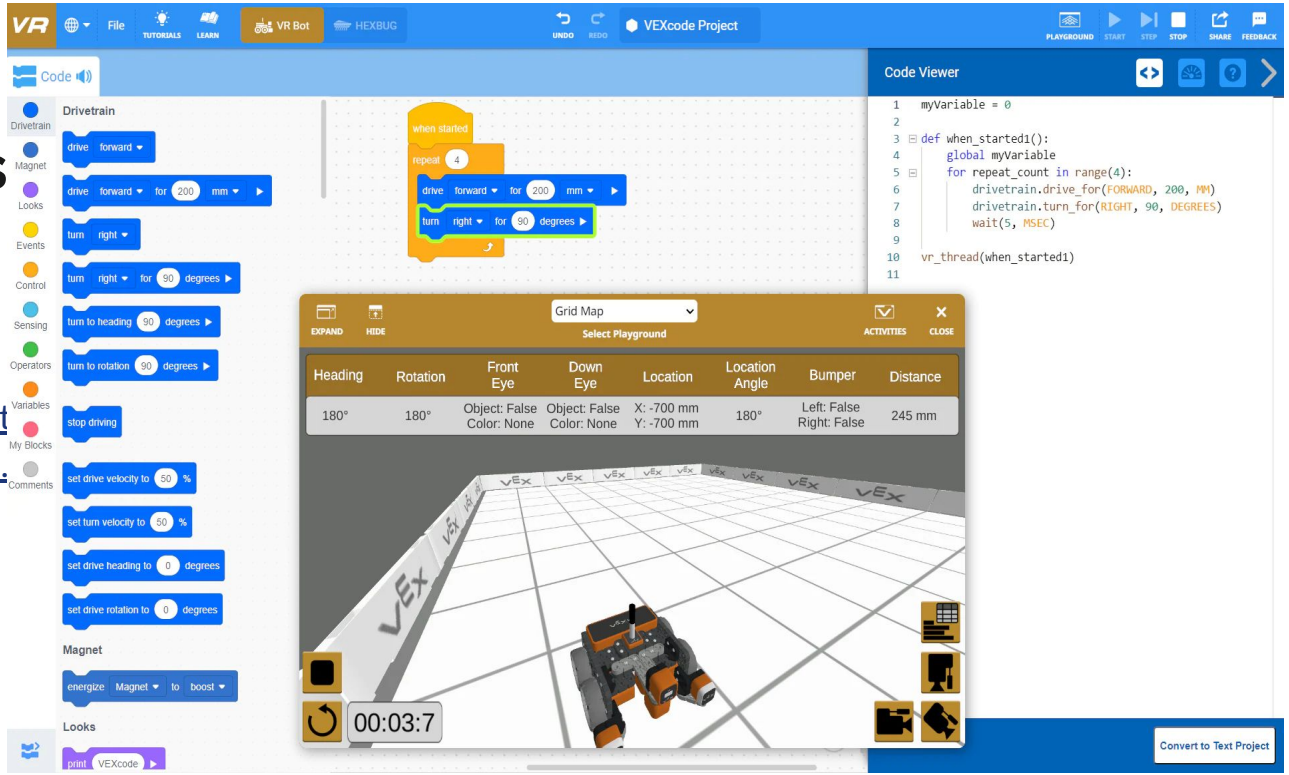
Classroom Robots

Hands-on

- iRobot - pen and motion with sensors
- Sphero - general control and measurement
- Lego - large scale complex system
- Vex - battle bots and completion challenges
- – created a VR Robot option which uses the same coding.

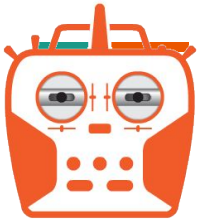
Virtual Robots VEX-VR

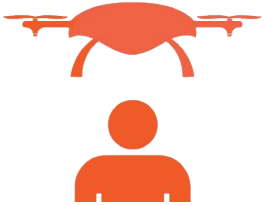
- https://www.vexrobot
- https://www.youtube.
- https://vr.vex.com/



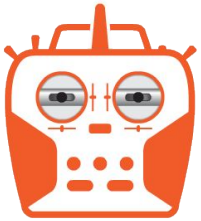
Drones (unmanned aerial vehicles)

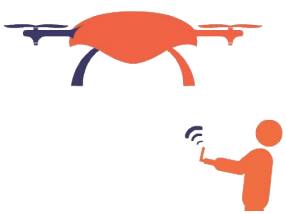
- Drones are Robots that “fly”
- Have AI to manage basic aerodynamics, so they are easy to fly
- Data Collection system
- Manual Control
- Automate or pre-program flight path
- Applicable to classroom uses





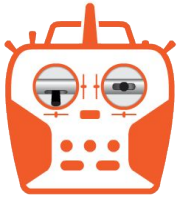
How do drones fly?

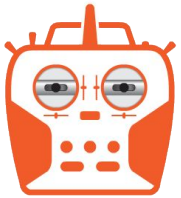




Rotation around the front-to-back axis is called **roll**. – Right stick left or right

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





Throttle controls lift. – Right stick up and down

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

Different Types of Drones from DJI

1) Tello
2) DJI Mini
3) DJI Mavic Air
4) Air 2S

What's a Tello box appropriate for Classroom ($150)

1. DJI Tello
2. 3 Batteries
3. Multi-Battery Charger
4. Charging Cord
5. Extra propellers

Drone Terminology

- UAV – Unmanned Aerial Vehicle
- UAS – Unmanned Aerial System
- Quadcopter – Aircraft that uses four motors and four propellers
- PIC – Pilot In Charge
- 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

Hands on with Drones

GPS

Aerodynamics

Sensors to manage stable flight

Communicate using WiFi for distance

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.

Drone Safety

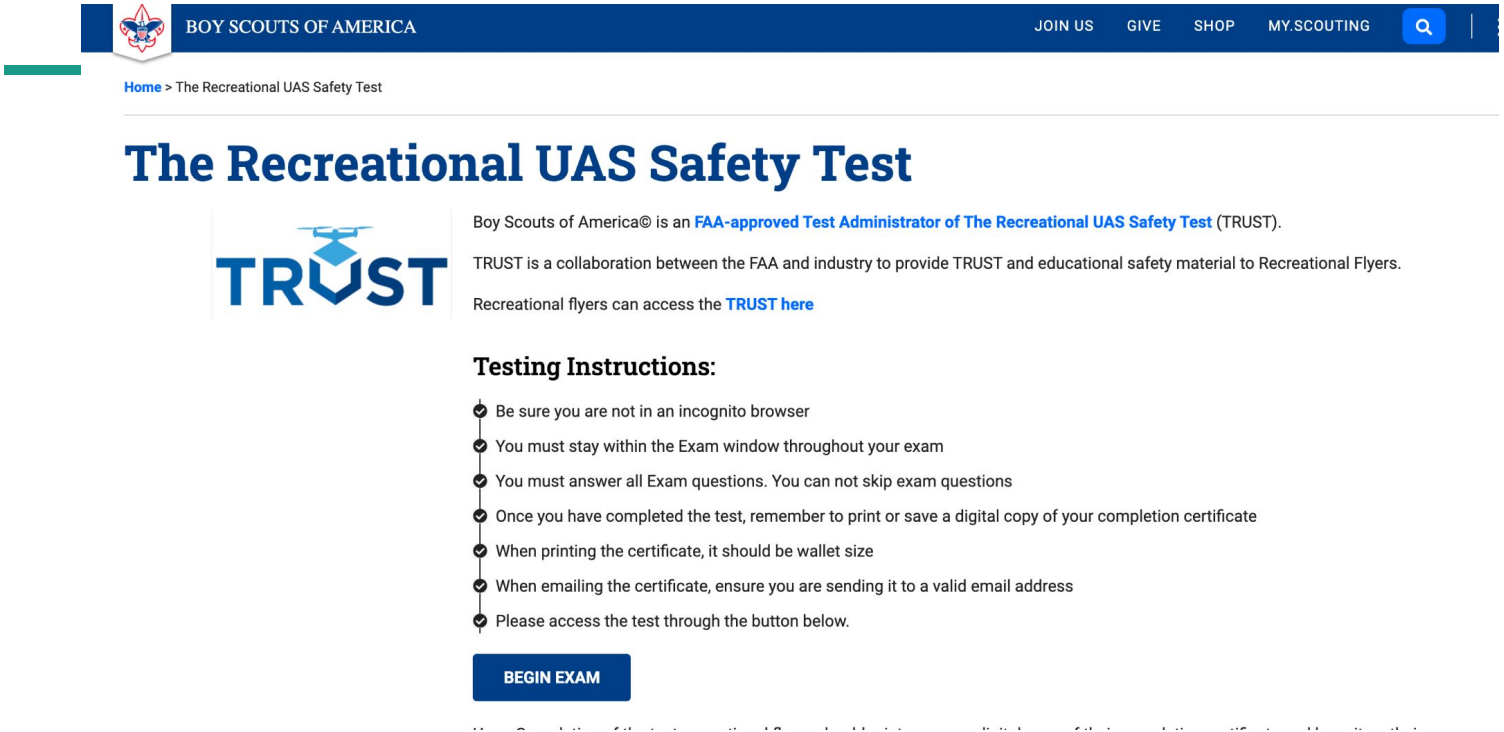
FAA guidelines

- Sect 107 license
- Basic license for hobby and school
- Weight limits and need to register
- LOCATION limits
- Weather issues
- Time of Day

TRUST
The Recreational UAS Safety Test

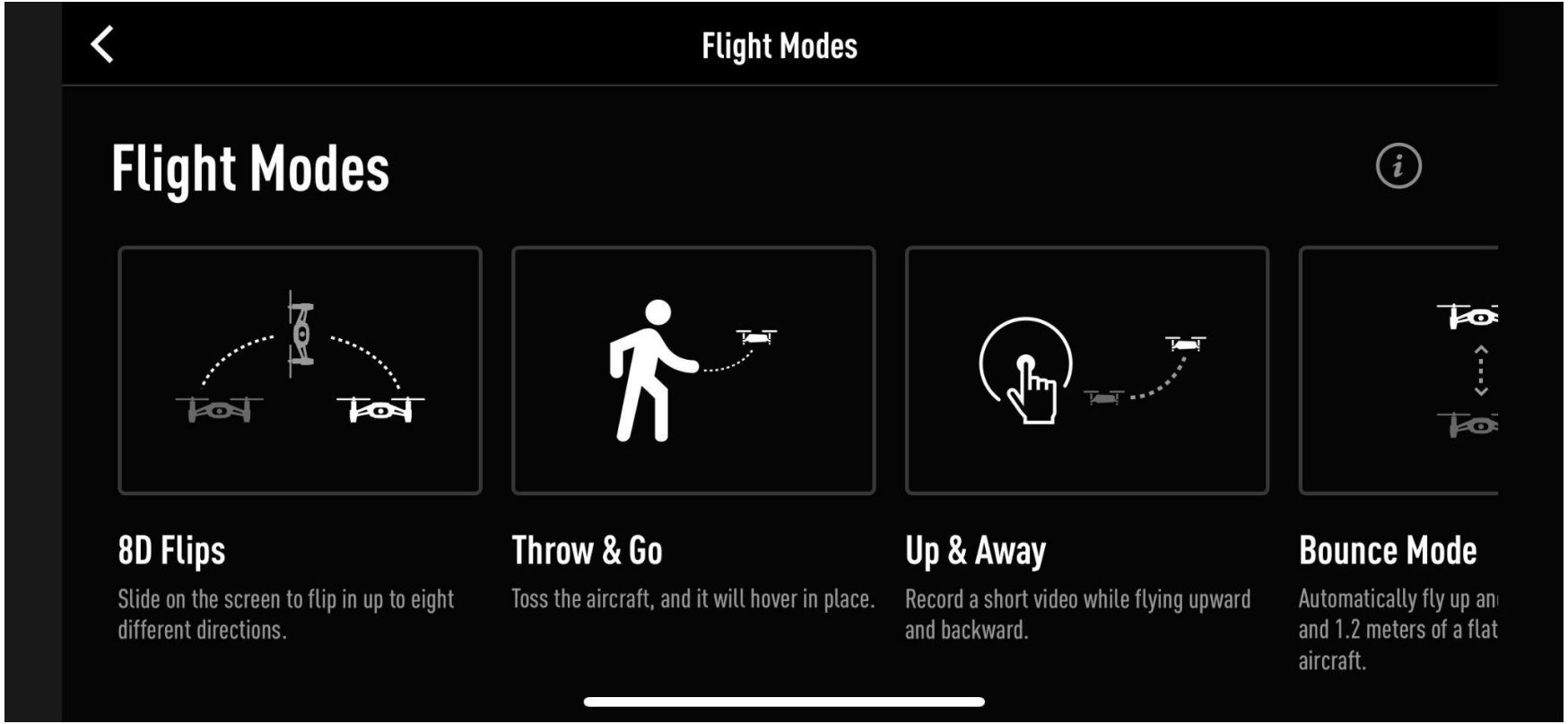
All recreational flyers must pass an aeronautical knowledge and safety test and provide proof of test passage (the TRUST completion certificate) to the FAA or law enforcement upon request. The FAA's 2018 Reauthorization Bill (PDF) introduced new requirements for recreational pilots (see P.L. 115-254,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

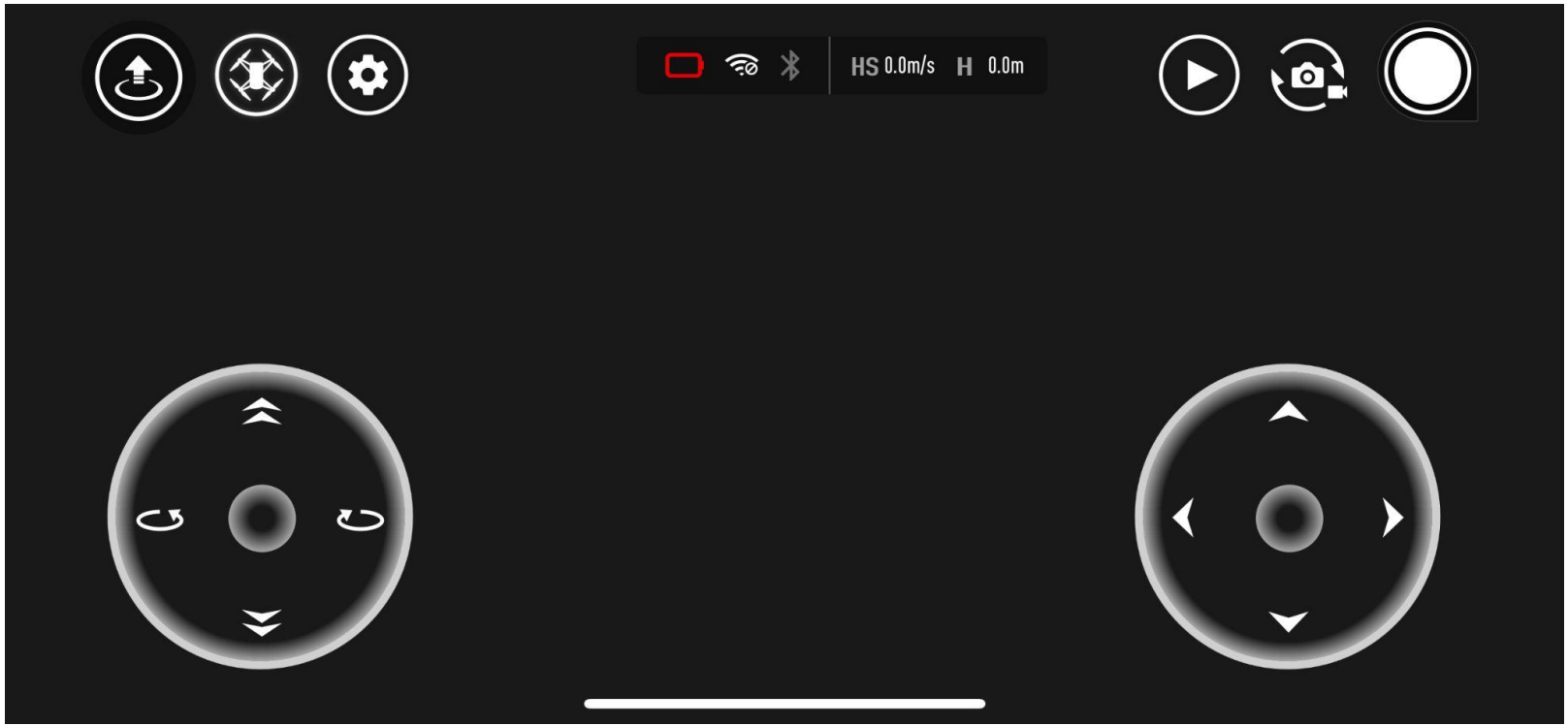
Let’s take The Recreational UAS Safety Test



AMA

Tello Flight Modes

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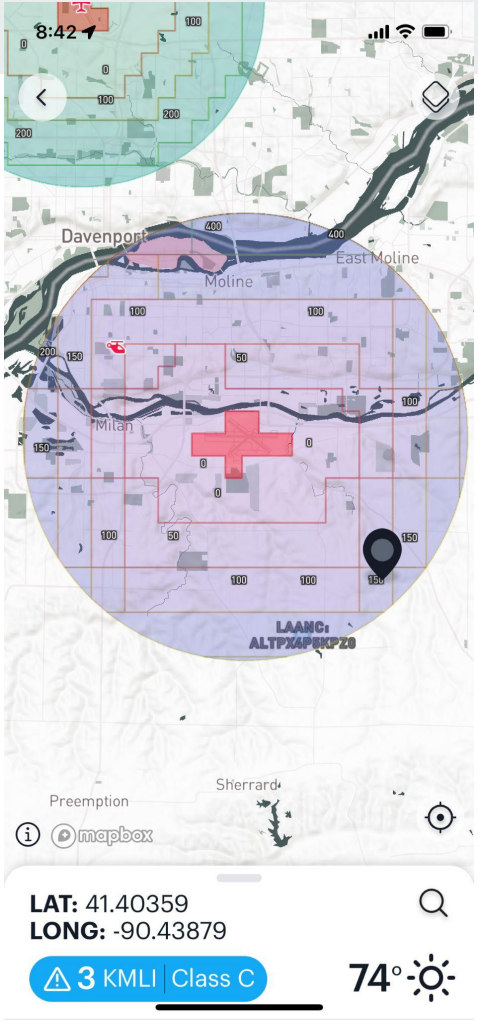
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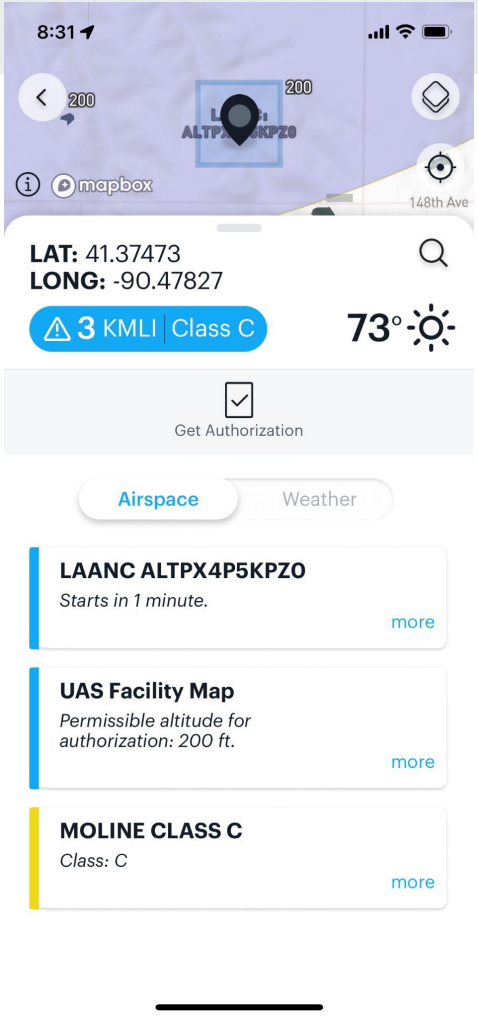
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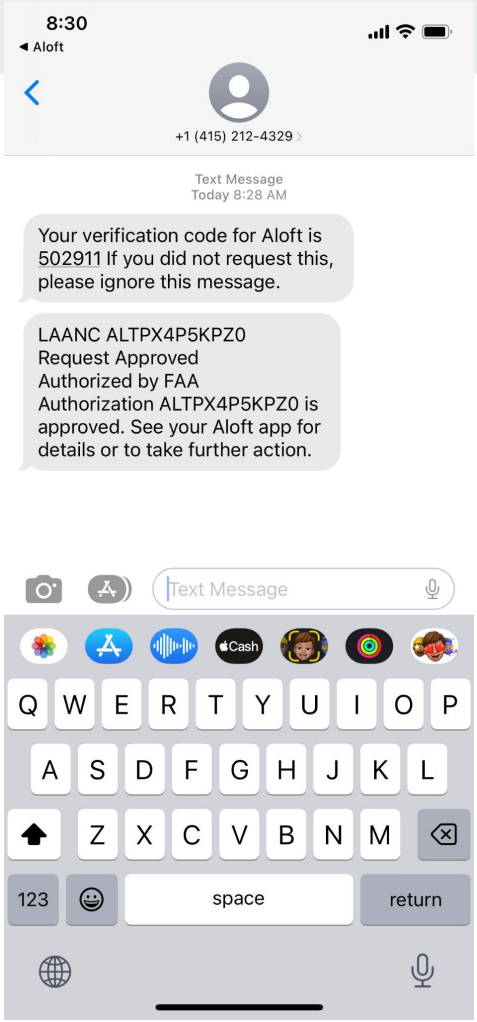
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Aloft
+1 (415) 212-4329
Text Message
Today 8:28 AM
Your verification code for Aloft is 502911 If you did not request this, please ignore this message.
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Request Approved
Authorized by FAA
Authorization ALTPX4P5KPZ0 is approved. See your Aloft app for details or to take further action.
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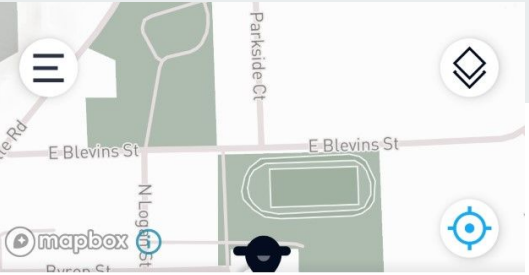

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⚠ 0 | 38°

Airspace | Weather

Summary
38°
Clear

Wind
8mph
From E

Gusts
15mph

Visibility
10.00mi

FLY

Air Control & Weather

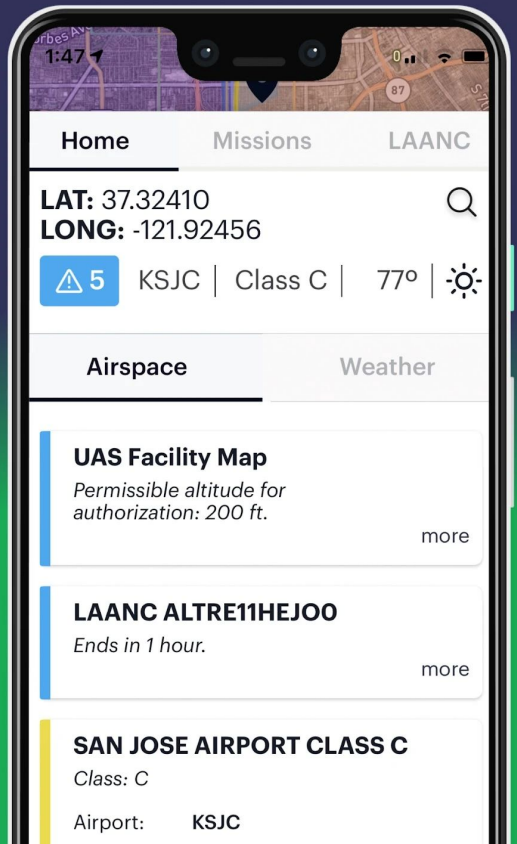
ALOFT - Air Control (app)

Air Space Restrictions

Weather Details

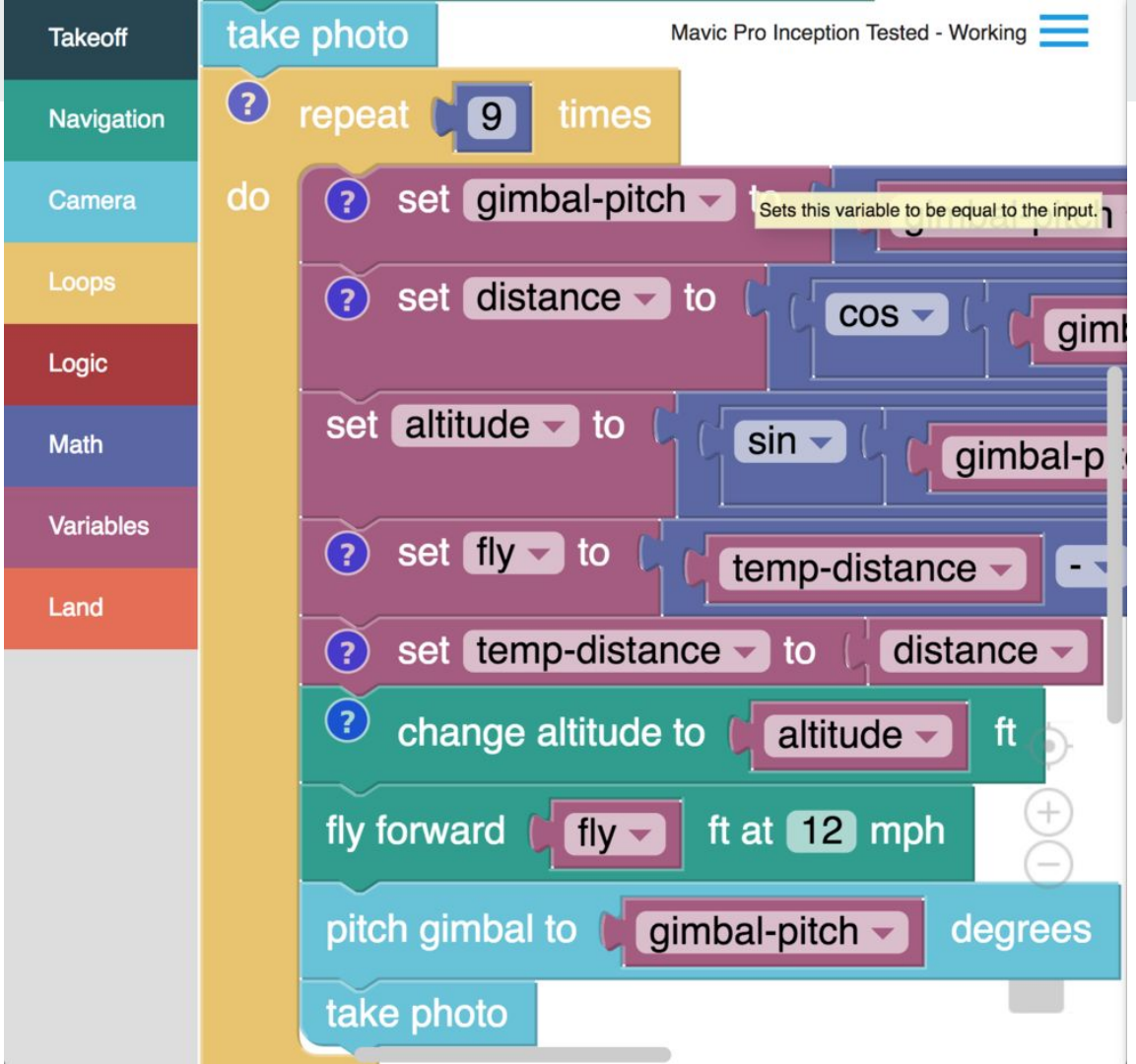
Nearby Sensitive Areas

View authorizations directly from Dynamic Airspace

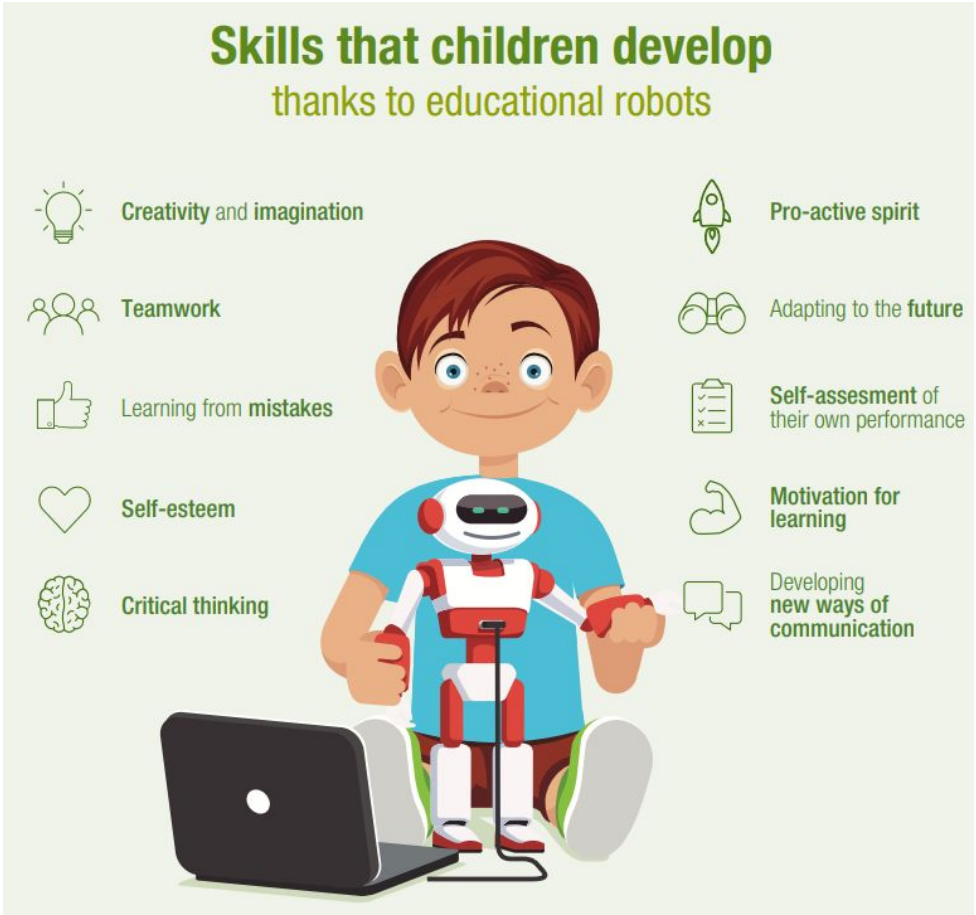


Drone Blocks

Pre-Program the flight path

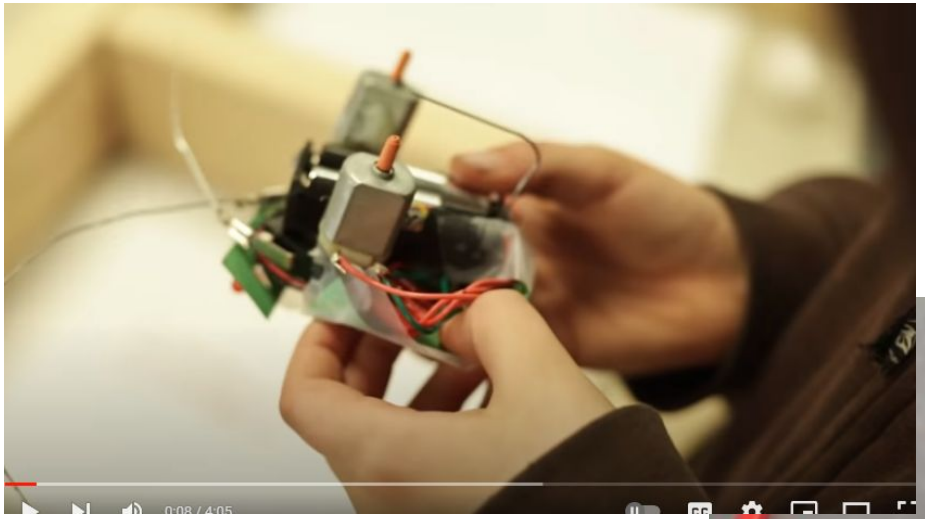


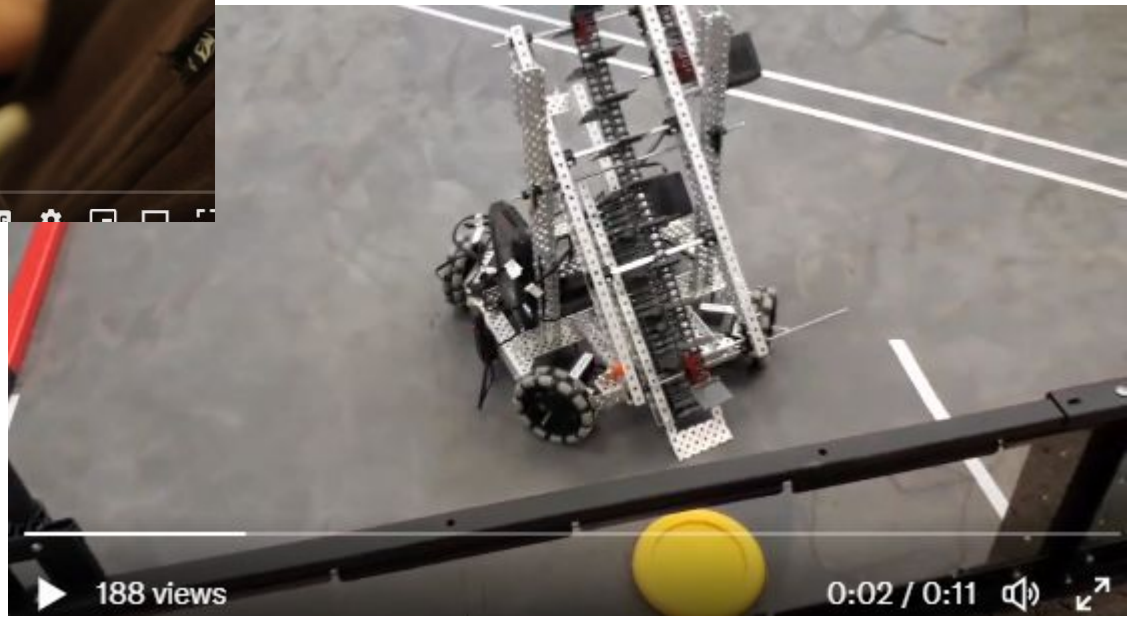
How would you use Robots and Drones with your students?



Classroom Curriculum

Robots





https://www.youtube.com/watch?v=OlYwHNKN-qw

https://twitter.com/i/status/1585416732025683975

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

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/

Q&A plus Wrap-up

Extra Slides follow from here. They're from the LTC presentation which was drones only and a half day session.

They contain high interest drone videos and a wealth of links to drone resources.

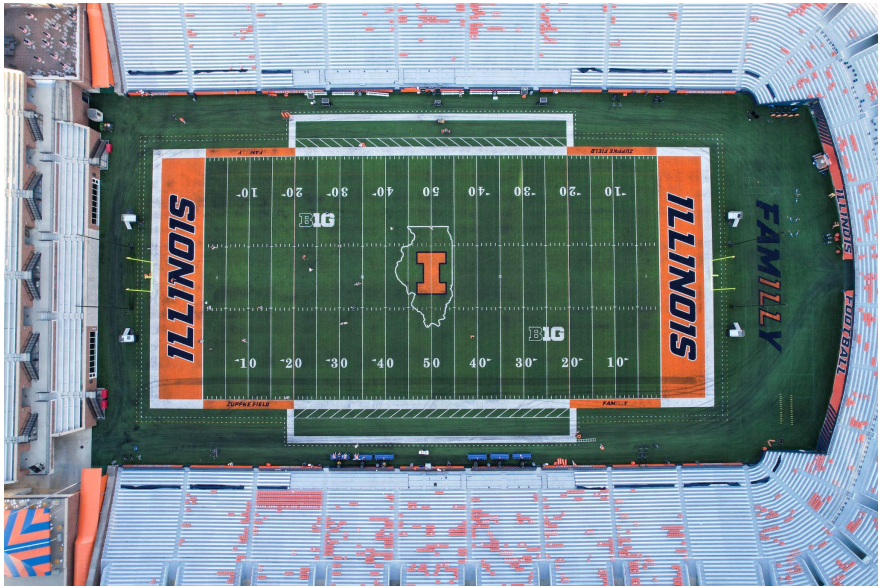
Uses For Drones

- 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
- Amazon Drone Delivery
- Many, many more

Drones for Spraying Part 137 Information


SkyElements


MEMORIAL STADIUM
HOME OF THE
FIGHTING ILLINI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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

Tips

- Start With Realistic Expectations
- Spend Only What You Can Afford to Lose
- Become a Skilled PIC
- Practice and Fly Regularly Even as an Expert
- Hobby First, Curriculum Next
- Buy Extra Batteries, Propellers, and Guards
- Use YouTube for your Specific Drone(s)
- Join a Community and Share
- Research, Research, Research
- Follow All Safety Rules

Apps to Download

a. Tello App - iOS
   i. Tello - 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 - iOS
   i. Drone Blocks - Android
   ii. Drone Blocks Chrome Extension
c. Aloft - iOS
   i. Aloft - Android

Rules for Flying

What are the safety guidelines for sUAS 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

Recreational Safety 2

- Do not intentionally fly over unprotected persons or moving vehicles, and remain at least 25 feet away from individuals and vulnerable property.
- Use Aloft 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).

What is a commercial use of UAS?

Any commercial use in connection with a business, 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

What are some examples of commercial uses of UAS?

- Professional real estate or wedding photography
- Professional cinematography for a film or television production
- Providing contract services for mapping or land surveys

Using Aloft to Confirm a Flight Plan

Get to know the Tello

Coding the Tello!

Let’s go fly!

Possible Next Steps

Cost Factors in Drones

- Size
- Weight
- Camera
- Battery Time
- Autopilot
- Return To Home (RTH)
- Wind Tolerance
- Payload
- GPS

Drone Options

Starter Drones

Ryze Tech Tello - $149.99

UDI U818A-HD - $43.99

RoboMasterTT

Class Set of Drones

Racing Drones

Tinyhawk 2 - $129.99

Coding Drones

CoDrones - $215

Mid Level Drones

DJI Mini 2 - $499

DJI Mini SE - $299

High Level Drones

DJI Mavic Air 2 - $999

DJI Phantom 4 Pro - $1,599

DJI Mavic 3 - $2,199