QUADS AWAY

A Curriculum Based on Quadcopters Written By a Part 107 Certified sUAS Pilot

A Drone Curriculum For All
By Keith Jacobs Jr.

- Ground School
- Flight Training
- Real World Missions

Terminology
Aerospace Principles
Drone Parts and Functions
FAA sUAS Laws and Regulations
Mission Checklists
Flight Logs
LAANC Authorization Procedures
TRUST Test
Basic & Advanced Flight
Maneuvers Online Recon Missions
Training Missions
Real World Missions.

Illinois Extension

COLLEGE OF AGRICULTURAL, CONSUMER & ENVIRONMENTAL SCIENCES

About This Curriculum

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Congratulations! You have made the wise choice of embarking on a knowledge and fun filled journey into the world of drones. Whether you are a solo pilot tackling this curriculum alone, or a group of new pilots working with a project instructor/teacher, you will find that this curriculum is designed for you. The goal of Quads Away: A Drone Curriculum For All is to incorporate the various Science, Technology, Engineering and Math (STEM) fields into an easy to follow curriculum that helps the user to understand drones and their technologies in a comprehensive way. Through the use of a multimedia approach, users will be guided through three (3) progressive sections:

1. Ground School, which introduces users to the terminology, technology and basics of the drone industry before taking flight. In addition, users also explore the relevant aerospace principles involved in drone flight.

2. Pre-Flight School, which guides users through the relevant UAS laws and procedures involved in flying drones. Also users will learn how to complete mission checklists, flight logs, and gain flight approval through the LAANC automatic approval system. At the end of this section, pilots will take the FAA TRUST Test (required before flying UAS over .55Lb outdoors).

3. Flight School. which develops user's skills from basic to advanced maneuvers through the use of both training missions and real world missions. Users will be able to apply the skills learned in Part 1 and Part 2 to become competent and safe recreational pilots.

This curriculum includes several activities to aid in the learning process, and also encourages youth to use internet sources through Online Reconnaissance Missions. As an FAA Part 107 Certified sUAS Remote Pilot, I have included as much relevant drone information as I could without it becoming overwhelming. For those wishing to gain more information on particular topics, an additional resource page has been included for that purpose.

You will notice that this curriculum does not have an Index/Glossary. That is intentional. It is expected that the youth use modern technologies to come up with answers to the posed questions, and verify amongst each other. For many of the activities, the final answer is not what is important, but rather the thought process used to arrive there. This curriculum is not designed to create content experts, but rather process experts capable of using their resources and intellect to obtain the knowledge and skills needed to become a competent recreational Drone pilot.

Thanks, and Good Luck!

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SECTION 1
GROUND SCHOOL

If you are reading this, it is likely because like many of us, you are interested in learning about the flying robots that are typically referred to as Drones. If this is the case, you have come to the right place! Before we get started with our multi-media, interactive exploration of the topic, it is important that we first become familiar with some of the terms, acronyms and language used in the drone community to better help us understand the lingo. Let's get started!

Drone, UAV, or UAS?

Typically when you think of a flying robot, what word comes to mind? If you thought "Drone" you would be correct. The word drone is the most commonly word used to describe what are known as Unmanned Aerial Vehicles (UAVs) or Unmanned Aerial Systems (UASs). While these two words are often used interchangeably, there is one BIG difference between the two.

As stated in the name, a UAV is an Unmanned Aerial Vehicle (synonymous with drone). This means that the robot or vehicle is capable of flight, and does not contain an onboard pilot. Instead, the pilot is located somewhere else (remotely) and is controlling the aircraft from a distance. The term RC is used to describe the remote or radio control of a UAV/UAS. Unlike a UAS, the acronym UAV ONLY refers to the vehicle (the plane, helicopter or multirotor).

On the other hand, a UAS refers to the entire Unmanned Aerial System. This includes the vehicle as well as a whole system of components that are used to control the vehicle, and monitor its movements and actions. Most commonly, these systems are made up of the UAV, a pilot, a ground control station (GCS) which can communicate directly with and monitor the UAV (often a computer or phone), both video/radio transmitters and receivers (TX/RX), sensors, and more!

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Activity 1
The Basics ✕✕✕✕

Try doing this activity in smaller groups before coming back to the larger group to discuss. If you are a solo pilot, think to yourself about what each term means before answering.

1.   Define the following:

      a.   Drone?_____

      b.   UAV?_____

      c.   UAS? _____

      d.   RC? _____

2.   Next, determine if the following are a UAV, UAS, or Neither.

      a.   An RC Plane with Batteries and a Remote? _____

      b.   Quadcopter with GPS, Pilot, Video Capabilities, App to fly (GCS)?_____

      c.   Quadcopter with a Camera but no GPS or Video Capabilities? _____

      d.   Hexicopter? _____

      e.   Paper Airplane?_____

Over the past several years, drones have made their way into the public eye, and have come a long way since the days of scratch building hardware and software systems to match. While the technology has advanced tremendously in the past 5-10 years, the basics remain the same, and this knowledge will enable you and/or your club to study, and one day if you choose, even design & build your own personal drones!

Drone Flavors

Drones come in many different shapes, sizes and configurations. For simplicity, we will focus on two different types: multi-copters and fixed winged airplanes. These both have very different capabilities and advantages.

Multicopters

A multicopter/multirotor refers to a drone that has two or more propellers (props) that provide lift for the aircraft. These include:

Bicopters (2 props), tricopters (3 props), the well-known and traditional quad copters (4props), and hexicopters (6 props). While they are typically reserved for professional applications, many high capacity/heavy lift drones come with 8-16 propellers!

Some drones are configured in an X pattern with the motors opposite one another while others are configured in a Y pattern with two motors in the front and one in the back. Some even have propellers on the top AND bottom of the frame! The number of propellers on a multicopter is really only limited by the battery and weigh capacity of the aircraft.

Most consumer drones on the market are self-stabilizing, and use a variety of technologies to keep them safely in the air.

What does that mean?

That means that when the drone takes off, it is able to stay level or parallel to the ground when it is not moving or once the pilot lets go of the control sticks (on the remote/transmitter). Typically these drones can fly up to 40 miles per hour.

Standard Quadcopter

Drones Racing

On the other hand, there are many drones that are non-stabilized and require constant pilot input to stay in the air.

What does that mean?

This means that the drone will not stay level or parallel to the ground even after the pilot lets go of the control sticks. The drone will continue to fly in the direction that the propellers are pointed. This is the case with most racing drones/ drones that fly in manual or rate mode. Many of these UAVs can fly over 80 miles per hour!

Fixed Wing Aircraft

Fixed wing airplanes are what we typically think of when thinking about an airplane. Just like multicopters, there are many flavors of fixed wing aircrafts. Some have tails with stabilizing wings, some have a small wing in the front and a large wing in the back, and some even take off vertically from their tails!

The thing that makes them all the same is that they have wings that are fixed in one position and provide lift for the craft. In addition, with the exception of gliders they all have at least one motor that spins a propeller to provide thrust for the aircraft.

**Fixed Wing
Military Drone**

Online Recoonaissance Mission 1 ✖✖✖✖

Identify one of each kind of drone listed below. If possible, find information about the configuration, brand/name, flight time, size, and the range (how far it will fly before losing signal). Try doing this activity in smaller groups before coming back to the larger group to discuss. Each group should share their answers with the larger group and debrief together. If you are a solo pilot, take a minute to explain these terms to someone that may not know about drones like a parent or a friend.

Configuration	Brand / Name	Flight Time	Size and/or Weight	Range
Tricopter / Y3				
Quadcopter/ X4				
Hexicopter/X6				
Octocopter/X8				
Other:				

Debrief

Did you see a relationship between the configuration and the size of the drones? What about between the Flight time and configuration? Any relationship between the size and range? What do you think determines or contributes to range and flight times? Discuss as a group.

General Applications ✕✕✕✕

While many people who purchase or build a drone will only fly recreationally, there is a growing list of drone applications both personally and commercially. Keep in mind that to make money flying drones, you must possess a part 107 sUAS license from the FAA. Details on how to become licensed are located later-sections of this curriculum.

The most common non-recreational drone uses outside of photography and videography are:

Package/ Med Delivery.

Aerial   Mapping/ Surveying/ Agriculture

Emergency Management & Response

Drone Racing

As the technology advances, more and more uses for these devices are being tested all over the world. Details on Common Applications are located in later sections of this curriculum.

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