KANE AREA SCHOOL DISTRICT

High School STEM Curriculum
(Science, Technology, Engineering, Math)

Prepared 2023

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Artificial Intelligence/Cyber Security/Animation

Statement of Organization:
This course will teach students about the core ideas of Artificial Intelligence (AI) and how data is collected and arranged. The core ideas will challenge students to explore six general structures of AI: Artificial Intelligence, Machine Learning, Deep Learning, Natural Language Processing, Computer Vision, and Problem Solving. The course will cover the critical concept of cybersecurity from the personal to corporate level. Students will take the time to consider digital footprints, the basics of the Internet, binary code, encryption, and cybersecurity jobs. This course will also teach students animation basics through traditional celluloid animation and stop motion photography. In 3D animation, students will learn about its rapid advancement and influence throughout multiple industries.

Expected Levels of Achievement:
Students are expected to achieve mastery of concepts and skills presented by obtaining an eight percent (80%) or better on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Project
- Demonstration
- Rubric
- Checklist
- Worksheet
- Exit Ticket

Estimated Instructional Time:
Artificial Intelligence/Cyber Security/Animation is a half-credit elective which meets for a minimum of sixty (60) clock hours and is available for students in grades 9-12.

Technology Integration:
Students will use technology as a core requirement of the course.

Standards:
NGSS

- HS-ETS1-1
- HS-ETS1-2
- HS-PS4-3

ISTE

- Empowered Learner 1a, 1b, 1c, 1d
- Innovative Designer 4b
- Creative Communicator 6c
- Global Collaborator 7c

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
Introduction to Artificial Intelligence (AI) in Modern Life	Students will see how AI are being used in a variety of industries around the world. They will also learn how the rules, laws, and ethics around personal and professional uses of AI are still being formed.	• Practice a variety of digital literacy skills to acquire knowledge in modern uses of AI. • Discuss the legal uses of AI and how laws are being shaped as the industry grows. • Identify both sides in an ethical issue. • Analyze social issues surrounding AI, data collection, rights of privacy, and more.	Root node Decision node Terminal node Branch Leaf Splitting Deep fake Field Value Form Database Record Table Row/Column Filter Sort Query Format Asset Group Category
Pattern Recognition and Machine Learning	Students will examine sample data and learn to train AI systems to recognize patterns. Students will explore how AI learns to see patterns in the data.	• Identify basic models of AI learning methodology. • Explore how the various models are used for specific programmatic advantage. • Build their own decision tree or decision forest to find results within a dataset. • Discuss vocabulary to support learning.	
Machine Learning, Predictive Text, and Coding Languages	Students will learn to write a basic set of instructions for a machine based on data.	• Demonstrate how software systems can create an interface for users to experience AI without knowing a great deal of code. • Identify AI vocabulary and how it is used in context. • Analyze how data, text, photos, and video can be used in conjunction with an AI to produce new results. • Create their own version of an existing work of art. • Discuss how complex systems need reliable data to process results most efficiently.	
AI and the Arts - Generative Design & Creativity	Students will experiment with AI technology to build creative works.	• Design original, creative works. • Identify important limitations of AI technology. • Manipulate existing datasets and AI resources. • Analyze online activities to generate art, music, and text based on human-created datasets of images and writing. • Discuss the ethics of creating ‘deep fakes’ by manipulating images.	
AI and Data Science	Students will discover how data are collected from a variety of sources and stored in a database.	• Identify key vocabulary and processes related to databases and data collection. • Explore types of data structures and their relationships. • Set up sample data interactions with data using query language. • Analyze how AI systems may solve human problems using data sets.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
Ethics in AI	Students will understand an issue, form an opinion, and make a choice. Students will be challenged to defend their choice using logic, fact, opinion, and feeling.	• Explore popular cultural issues related to AI use. • Form positions on issues and defend them. • Communicate their opinions using a variety of skills—verbal and non-verbal communication, persuasive speaking, encoding and decoding messaging, and declarative statements.	
Introduction to Cybersecurity	Students will be introduced to cybersecurity, how the Internet works, and what it takes to keep our information secure.	• Define cybersecurity. • View a map displaying live cybersecurity attacks. • Describe different types of cyber-attacks. • Define cybersecurity terms and definitions.	Cybersecurity Norse map Attack (origin, targets, types) Encryption Hacking Keyboard logger Ransomware Identity theft Malware Sniffing Incidence response Phishing Spoofing Threat Virus Spyware Trojan Ethical hacker
Binary Numbers	Students will make the connection that all data is in binary, thus making binary important to cybersecurity specialists.	• Convert a decimal to binary. • Convert binary to a decimal. • Investigate ASCII values for characters and how to represent them in binary. • Write their name in binary using ASCII.	
Cryptography	Students will learn the history of cryptography and how it is used today.	• Explore cryptography and how it is used to send data securely over the Internet. • Create their own cipher wheels to send and receive codes. • Encode and decode messages using a Linux terminal.	
Electronic Communication and Privacy	Students will gain awareness of their digital footprint so that they may mitigate negative consequences of sharing information online.	• Explain different forms of electronic communications. • Explore how data contained within electronic communications are saved and tracked. • Investigate their own digital footprint and the story that their electronic data is telling about them.	
Being Safe Online	Students will investigate and discuss the consequences of engaging in risky behavior online and develop a plan for protecting themselves.	• Communicate what it takes to stay safe online. • Create a unique and secure password. • Investigate and discuss the consequences of engaging in risky behavior online. • Create a list of things that should never be posted online.	
Cybersecurity Careers and Simulation	Students will learn about the careers available in cybersecurity and what is required to pursue a career in this growing field.	• Explore the high-demand job market of cybersecurity. • Investigate the various positions available in the career field of cybersecurity. • Explore the various tasks, salaries, and growth rates of the positions within cybersecurity.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
		• Participate in a simulation where they become cybersecurity specialists for a company that falls under attack.	
Principles of Animation	Students will explore the roots of animation, identify the main types of animation, and discover the principles of animation.	• Identify animation types. • Design and share a GIF. • List, sketch, and act out the 12 Principles of Animation.	Squash and Stretch Anticipation Staging (Line of Action) Straight Ahead and Pose-to-Pose Follow Through and Overlapping Action Ease In and Ease Out or Slow In and Slow Out (spacing) Arcs Secondary Action Timing Exaggeration Solid Drawing Appeal Frame FPS—Frames per second Cel (short for celluloid) Layer Onion skinning CGI—computer generated imagery. 3D—three dimensional Camera Rigging Graph editor Texture mapping Bezier curve Vector object Timeline Keyframe
Traditional 2d Animation	Students will apply the principles of animation to create animations using physical and digital flipbooks.	• Explore the roots of animation. • Illustrate a physical flipbook. • Animate a digital flipbook.	
3d Animation	Students will build on their knowledge of 2D animation by moving 3D objects in frames through an open environment.	• Manipulate a 3D model. • Animate a 3D model.	
Stop Motion Animation: Robot Remix	Students will create stop motion animation.	• Create a stop motion video. • Program a robot. • Collaborate in teams.	
Vector Animation and Motion	Students refine their animation skills with vector objects.	• Animate a stick figure to move naturally with fluid movement using vector objects. • Manipulate a stick figure using Bézier curves.	

Engineering Design Process/Robotics

Statement of Organization:
This course will teacher students to design structures to solve everyday problems. These solutions will be created using 3D-design printing software. This course will also teach students to be computational thinkers, understand how automation works, and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

Expected Levels of Achievement:
Students are expected to achieve mastery of concepts and skills presented by obtaining an eight percent (80%) or better on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Project
- Demonstration
- Rubric
- Checklist
- Worksheet
- Exit Ticket
- Presentation

Estimated Instructional Time:
Engineering Design Process/Robotics is a half-credit elective which meets for a minimum of sixty (60) clock hours and is available for students in grades 9-12.

Technology Integration:
Students will use technology as a core requirement of the course.

Standards:
NGSS

- HS-ETS1-1
- HS-ETS1-2
- HS-ETS1-3
- HS ETS1-4

ISTE

- Empowered Learner 1a, 1b, 1c, 1d
- Digital Citizen 2b
- Knowledge Constructor 3a-3d
- Innovative Designer 4a-4d,
- Computational Thinker 5a, 5c
- Creative Communicator 6a-6d
- Global Collaborator 7c

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
Identification of a Problem and Solution	Students will identify a problem, empathize with someone affected by the problem, then prototype a solution.	• Use the design thinking process to solve a real-world problem. • Use empathy and understanding to identify those affected by a problem. • Use interviewing and writing to clarify and define the problem.	Design process Sanding Polishing Painting Market research Pitch material.
Empathize and Make	Students will build a prototype that could serve as a "proof of concept" for an invention.	• Use the design thinking process to solve a real-world problem. • Use empathy and understanding to identify a person or persons affected by a problem. • Draw concept sketches for new solutions. • Make a prototype or prototypes using found materials (cardboard, tape, glue, paper, etc.).	
Design and Build	Students will use 3D-design software to design objects that can be 3D printed and tested for functionality.	• Use the design thinking process to solve a real-world problem. • Design a prototype using 3D-design software.	
3D Printing	Students will prepare their designs for 3D printing.	• Use the design thinking process to solve a real-world problem. • Use trial and error to refine and perfect the printed object. • Analyze the 3D design for structural failures, overhang, or orientation issues. • Produce one or more 3D-printed versions of their final design. • Test the printed object and collect feedback. • Identify failures and successes in the prototype. • Refine their design and create additional prototypes and failure/success feedback loops. • Learn how to sand, polish, clean, and/or paint the final 3D-printed object as needed. • Produce a final prototype that solves the problem.	
Research, Preparation, and Presentation	Students will conduct basic market research to prepare for a presentation.	• Photograph their product in use to be included in their presentation. • Research sales markets for their product to be included in the presentation. • Research existing patents, copyrights, or existing products similar to their own to avoid conflicts. • Construct a slide-to-slide presentation using available presentation tools. • Deliver a short, pitch-style presentation to a larger group. • Conduct peer and self-evaluations.	
Thinking Like an Engineer	Students begin the process of thinking like an engineer, learning as a result of failure, and	• Discover the value of making things just for the sake of making.	Brainstorm Prototype

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
	finding humility in the process of designing something new.	• Reflect on the use of robots in modern industry and society. • Analyze how the Design Thinking Process can teach designers about failure and resilience.	Flow Input Output Conductor Controls Devices or loads Integrated circuit Power source Resistors Schematic Digital GPIO Analog GPIO TX RX Power port Power pins Ground pins Built-in LEDs USB port Microcontroller Resistance Polarity Concept sketch Technical drawing
What's in a Robot?	Students will begin to understand what components go into the physical design of a robot and how those components might fit together.	• Plan and design a robot using Design Thinking skills. • Learn how to create a 'robot flowchart' that demonstrates how components and electronics flow together. • Define robots and robotics and apply these definitions to real-world objects.	
Building Electrical Circuits	Students will gain experience working with a breadboard, power source, and inputs and outputs to build functional circuits.	• Create an electronic circuit schematic. • Calculate ideal resistor value. • Explain how circuits function using a breadboard and how electricity moves around a circuit.	
Robotics and Arduino	Students will learn about the Arduino logic board and how it can be integrated into their robotic diagrams. Students will learn the basic setup of an Arduino board, its capabilities, and how circuits and servos will easily translate to Arduino.	• Identify and label the Arduino board and hardware components. • Download and install the Arduino software onto a computer. • Build and run a sketch using Arduino coding language	
Adding Movement and Controls with Arduino	Students will use a variety of design tools, both physical and digital, to plan and execute circuits that include an Arduino controller in the diagram.	• Create a flowchart and circuit diagram that includes a servo motor, fan, or DC motor. • Analyze how a moving part will be powered and controlled in a circuit. • Build virtual models and circuit diagrams to plan and organize the moving part.	
Learning to Code with Arduino	Students will explore how computer programming can be used with an Arduino to perform tasks, respond to stimuli, and make components move or change in very specific ways. Students will explore computer coding basics with Arduino.	• Learn the thought process behind coding actions using Arduino and electronics hardware. • Demonstrate how to write and test code on the Arduino board. • Troubleshoot and modify the Arduino code. • Develop a mindset to deal with success, failure, and to learn from mistakes.	
Circuitry and Servos in Real Life	Students will use design thinking to develop a plan that will add a moving part to a circuit to create a basic robot and an Arduino to control the movement through programming. Students will use hardware and software to design, build, and test physical and virtual machines.	• Build on prior knowledge to plan and diagram a circuit with a moving part. • Create a working physical circuit using hardware electronic parts. • Review the resistance formula to identify the correct resistor to use in the circuit. • Write, execute, and troubleshoot computer code to control the circuit and moving part.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
The Making of a Machine	Students plan, design, build, test, and finalize a robot that performs a task or solves a problem.	• Build a working robot using hardware electronic parts, a servo motor, and LEDs. • Integrate Arduino IDE programming code with robotic hardware and electronics. • Design, build, code, and troubleshoot a new robot/machine design from scratch. • Demonstrate the connection between idea, design, physical parts, and computer code. • Solve a real-world problem with robotics and computer code.	

Drones

Statement of Organization:
This course introduces students to becoming a Certified Drone Pilot. Students are exposed to a variety of tasks and knowledge building activities that will prepare them to pass the Part 107 Drone Pilot License exam. Students will be versed in how to build and repair a drone, read aeronautical charts, and conduct flight plans for various conditions.

Expected Levels of Achievement:
Students are expected to achieve mastery of concepts and skills presented by obtaining an eight percent (80%) or better on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Project
- Demonstration
- Log
- Rubric
- Checklist
- Worksheet
- Showcase

Estimated Instructional Time:
Drones is a one-credit elective which meets for a minimum of one hundred twenty (120) clock hours and is available for students in grades 9-12.

Technology Integration:
Students will use technology as a core requirement of the course.

Standards:
NGSS

- HS-ETS1-1
- HS-ETS1-4

ISTE

- Empowered Learner 1a, 1c-d
- Digital Citizen 2b
- Knowledge Constructor 3a-3c
- Innovative Designer 4a-4d
- Computational Thinker 5a-5d
- Creative Communicator 6a-6c
- Global Collaborator 7c

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
Introduction to Drones	Students will explore a variety of pictures, videos, and physical objects to orient themselves to using drones.	• Research unmanned aerial vehicles (UAVs). • Explain some basic uses for UAVs and drones. • Describe parts of drones, flight missions, and drone safety procedures using relevant vocabulary.	Transmitter Propeller Drone body Landing gear First person viewer (FPV) Line of sight (LOS) Throttle Take off Landing Roll Yaw Pitch Lift Drag Latitude Longitude Zero degrees point
	Students will create a personal flight log binder to keep track of flight time and mission details during this course.	• Organize flight time, mission data, post-flight reflections, and other relevant course information. • Create and maintain an organized flight log binder.	
	Students will explore the physics and dynamics of flight.	• Explore the physics of flight. • Investigate the motion of quadcopter propellers and how each motor controls one facet of movement. • Use terminology properly in context. • Model Newton's third law of motion and Bernoulli's principle using paper airplanes.	
	Students will evaluate the importance of knowing where they are, what the conditions are around them, and how certain conditions affect the performance of pilot and drone.	• Review a variety of tools to determine weather conditions in a given flight area. • Explore the six major conditions that make up a weather forecast or weather system and how they can affect a flight. • Give directions using the cardinal direction system. • Document a location using latitude and longitude. • Determine whether it is safe to conduct an outdoor flight in a specific location.	
	Students will demonstrate that they are ready to fly through documentation and knowledge of weather, direction, geolocation, and the location of their mission.	• Maintain an organized flight log binder. • Demonstrate understanding of weather conditions and direction in relation to flight performance. • Demonstrate understanding of geolocation using latitude and longitude. • Identify regional weather. • Identify potential restricted flight areas on a map.	
Learning to Solder and Building the Drone	Students will learn the basics of soldering.	• Identify the tools and supplies in their soldering kit. • Explain the purpose of each tool used in soldering.	Solder Soldering iron Multimeter Wire stripper De-soldering pump Screwdriver Wire Tweezers Solder tips
	Students will discuss soldering safety precautions and their importance. They will be required to pass a safety quiz before proceeding to the next module.	• Identify soldering safety precautions.	
	Students will solder their team's multiplexer lightboard.	• Solder a multiplexer lightboard. • Follow proper safety precautions.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
	Students will learn about all the parts that came with the drone.	• Identify the parts of the drone and the drone arm that they will be soldering	Multimeter Drone frame Battery Motor Electronic speed transmitter (ESC) Power distribution board (PDB) Flight transmitter (FC) Receiver Transmitter XT60 Drone arms Flight controller Prop guards Hex wrench Power distribution board Flux Antennae Electrical tape Multimeter leads Propellers Wrench
	Students will create the battery compartment on the drone frame.	• Work in a group to attach the battery compartment to the frame of the drone.	
	Students will attach the power distribution board to the drone frame.	• Work in a group to attach the power distribution board to the drone frame.	
	Students will attach the motors to the drone frame.	• Work in a group to attach the motors to the drone frame.	
	Students will attach the electronic speed transmitters (ESC) to the drone frame.	• Work in a group to attach the electronic speed transmitters to the drone frame using double-sided tape.	
	Students will learn how to use flux when soldering.	• Flux while soldering. • Solder battery cables to their power distribution boards.	
	Students will attach the flight transmitter to the power distribution board.	• Work in a group to attach the flight transmitter to the power distribution board. • Work in a group to attach the motor wires to the flight transmitter.	
	Students will attach the transmitter and receiver to the drone.	• Work in a group to attach the transmitter to the receiver.	
	Students will attach the antennae to the drone.	• Work in a group to attach the antennae to the drone frame.	
	Students will attach the propellers and battery to the drone.	• Work in a group to attach the propellers. • Check the drone for continuity using a multimeter. • Work in a group to attach the battery to the drone.	
Flight Mission	Students will assemble, disassemble, and inventory all the pieces and parts associated with their drone kit.	• Assemble and disassemble drones. • Identify motors by color or position. • Identify how motors result in drone movement. • Assemble the propellers on each motor. • Practice changing parts. • Practice changing batteries in and out of the drone compartment. • Charge spare batteries. • Measure battery power using a voltage meter.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
		• Maintain kit inventory.	
	Students will spend time orienting themselves to their aircraft.	• Perform a preflight check of the aircraft and flight area to determine flight readiness. • Assume the roles of pilot in command (PIC) and visual observer (VO). • Perform a flight challenge involving three maneuvers. • Master the power-up and power-down sequence controls.	
	Students will continue orienting themselves to their aircrafts by piloting increasingly complicated flight patterns.	Practice • Perform a preflight check of the aircraft and flight area to determine flight readiness. • Assume the roles of pilot in command (PIC) and visual observer (VO). • Perform a flight challenge involving three maneuvers. • Master the power-up and power-down sequence controls.	
	Student pilots hone their skills in maneuvering the aircraft.	Flight Level I Practice (logging hours) • Perform a preflight check of the aircraft and flight area to determine flight readiness. • Assume the roles of pilot in command (PIC) and visual observer (VO). • Perform a flight challenge involving three maneuvers. • Master the power-up and power-down sequence controls.	
	Students will complete the Flight Level 1 Skills Objectives maneuvers in a limited amount of time.	Badge Test • Conduct preflight checks to certify that the drone and environment are safe for flight. • Record flight time in their flight log binders. • Pilot their drones through a series of basic maneuvers. • Use proper vocabulary to describe movements.	
Square Flight Mission	Teams will be introduced to the task of completing a square flight pattern with complex directional changes.	Square Flight Patterns • Record flight time in their flight log binders. • Maneuver the drone through a series of elevation and directional changes. • Communicate with team members effectively. • Land the drone in the same orientation in its original position. • Practice guiding the drone through flight patterns.	
	Student pilots will hone their skills in maneuvering the aircraft allowing them	Square Flight Patterns - Each team will alternate pilot in command and visual observer roles, and log hours keeping an	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
	to master flight control at a deeper level.	accurate record of flight time in their flight log binders. • Record flight time in their flight log binders. • Maneuver the drone through a series of elevation and directional changes. • Communicate with team members effectively. • Land the drone in the same orientation in its original position. • Practice guiding the drone through flight patterns.	
	Students will continue to practice square flight patterns to sharpen their piloting skills.	X patterns - logging hours • Record flight time in their flight log binders. • Maneuver the drone through a series of elevation and directional changes. • Communicate with team members effectively. • Land the drone in the same orientation in its original position. • Practice guiding the drone through flight patterns.	
	Students will get the opportunity to gauge their progress by timing their flights.	Square Flight Patterns – timed runs • Record flight time in their flight log binders. • Maneuver the drone through a series of elevation and directional changes. • Communicate with team members effectively. • Land the drone in the same orientation in its original position. • Practice guiding the drone through flight patterns under a time constraint.	
	Each pilot will need to successfully plan and execute timed flights to earn their Square Flight badge.	Badge Test • Record flight time in their flight log binders. • Maneuver the drone through a series of elevation and directional changes. • Communicate with team members effectively. • Land the drone in the same orientation in its original position. • Practice guiding the drone through flight patterns under a time constraint.	
Sirius Enduro Mission	Students will focus on how real-world problem solving can be integrated into drone operations.	• Develop critical reading skills using the text or sections of the text from "The Martian." • Analyze themes from the book and relate them to real-world problem-solving challenges. • Make connections between fictional elements in the book and real-world science.	HAB Water reclaimer Oxygenator EVA Suit Rover
	Student groups will work together to save a stranded teammate.	• Complete a series of math, science, logic, problem-solving, and drone-piloting challenges.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
		• Connect characters and story elements in the book under time and space constraints.	
	Students are challenged to develop imagery and understand the Martian landscape.	• Read the "The Martian," watch the movie version, and discuss the content to increase reading comprehension. • Discuss important themes within the movie and book. • Make connections between the movie and book storylines, filling in important details, scientific elements, and plot.	
	Students will test and then execute a mission to test their maximum duration and distance flight plan.	Badge Test • Predict the distance their drone can fly in 5 minutes on a repetitive course. • Execute the Sirius 1 and Sirius 2 distance and time endurance challenges using a square flight course.	
	Student pilots will complete the Sirius 2 Mission challenge to earn their Enduro flight badge.	• Pilot a long mission around a simple course in a repetitive pattern while maintaining focus. • Build confidence and skill during a long flight.	
Maneuver Mission	Challenge pilots and engineers to build and fly a mission, pick up a payload, and then fly to a destination.	• Connect literary elements of the book, "The Martian," with real world experiences and engineering challenges. • Build and fly a variety of supports for two aircrafts. • Coordinate flying maneuvers with another team while strengthening communication skills. • Collaborate on data. • Work together to successfully complete the mission objective.	
	Teams will engineer a solution to resupply their spaceships, return to Mars to pick up a stranded teammate, and return home safely.	• Read the "The Martian" and watch the movie version to increase reading comprehension. • Make connections between the movie and book storylines, filling in important details, scientific elements, and plot. • Gain deeper context for the complexities of space travel. • Explore how the position of planets affects space travel. • Fly a complicated mission. • Build valuable communication skills while being challenged to fly in tandem. • Design a solution to a mission supply problem.	
	Students will continue to hone their skills in maneuvering the aircrafts through a difficult challenge.	• Practice guiding the drone through the flight patterns and moves of the Rich Purnell Maneuver Mission. • Exercise critical-thinking, communication, and problem-solving skills.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
		• Work together to successfully navigate a series of challenges.	
	Teams will be challenged to fly the maneuver mission according to the objectives without crashing. The mission requires teamwork and strong communication skills to perform a successful tandem flight. |	Badge Test • Conduct a tandem flight while demonstrating strong communication skills and intermediate level drone piloting skills. • Collaborate and work together toward the common goal of a successful mission.	
Pack the Rover Design and Build Mission	Students will use a variety of measuring techniques to design a carrying case for their drone equipment that is functional and promotes the safety and survival of their equipment.	• Use mathematics to measure and calculate square footage for each piece of equipment in the drone kit. • Design a storage solution that maximizes the use of space for each piece of equipment. • Build a functioning storage unit for all essential components, spare components, and safety equipment required to fly. • Work as a team to engineer, design, and execute a solution to the storage challenge.	Landing gear Battery charger
	Students will proceed with the building of their designs.	• Use mathematics to measure and calculate square footage for each piece of equipment in the drone kit. • Design a storage solution that maximizes the use of space for each piece of equipment. • Build a functioning storage unit for all essential components, spare components, and safety equipment required to fly. • Work as a team to engineer, design, and execute a solution to the storage challenge.	
	Student will put their end product on display for other students to see and evaluate.	• Complete the design and build of their storage case. • Prepare their product for display. • Create a short script to present their construction to the class.	
HAB to MAV to Hermes Mission	Students will be challenged to map a journey, calculating distances and elevation changes.	• Complete a study of Martian geography to map the path from the HAB to the MAV. • Use accurate vocabulary terms. • Connect story elements, like landmarks, to real world Mars topography.	Mawrth Vallis Arabia Terra Watney Triangle Marth Crater Terra Meridiani Entrance Crater Schiaparelli Crater
	Students will take a journey with their drones with obstacles, elevation changes, direction changes, and distance.	• Construct a multi-stage journey for drone teams to navigate. • Connect to story elements using names, locations, and elevations. • Gain experience piloting the drone over a variety of elevation and directional changes.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
		• Demonstrate strong communication skills.	
	Drone pilots will follow a pattern, change elevation, change direction, land, and repeat.	Badge Test • Construct a multi-stage journey for drone pilots and visual observer teams to navigate. • Connect to story elements using names, locations, and elevations. • Gain experience piloting the drone over a variety of elevation and directional changes. • Develop communication skills with the visual observer to navigate the sequence of obstacles efficiently	
Level 2 Flight Mission	Students flight practice with advanced flight maneuvers.	• Improve flight and maneuverability skills by flying circular and figure 8 patterns. • Acquire circular movement and yaw rotational control skills.	
	Students will work toward mastering the circular and figure 8 flight patterns through repetitive practice.	• Improve flight and maneuverability skills by flying circular and figure 8 patterns. • Improve their circular movement and yaw rotational control skills	
	Students will continue practicing advanced maneuvers and working toward mastery of the circular and figure 8 patterns. As skills improve, they will increase speed and distance as appropriate.	• Improve flight and maneuverability skills by flying circular and figure 8 patterns. • Master circular movement and yaw rotational control skills.	
	Students will be challenged to perform under the added pressure of a time constraint.	• Complete as many reps as possible on the circle and figure 8 pattern courses within a 2-minute time frame.	
	Pilots will be asked to demonstrate their flight skills on the two circular twisting patterns, successfully navigating each obstacle and drone rotation.	Badge Test • Demonstrate mastery of the maneuvers required for the circle and figure 8 course patterns.	
Lift and Load Mission	Students will study the effects of weight on an aircraft.	• Complete a Lift Equation worksheet. • Create a technical diagram and spec sheet for a drone.	Gravity Downward forces Counteracting forces Lift
	Students will work in teams to design and test a way for their drone to carry its maximum payload.	• Design and build a lift system for their aircraft. • Secure lift system to aircraft in a way that maintains proper balance during flight. • Calculate the maximum weight a drone is able to lift safely.	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
	Teams will coordinate their drone to carry an object from one location to another to complete the lift and load challenge sequence.	• Test a lifting mechanism on a drone in flight. • Improve the design and build of a lifting mechanism on a drone. • Explore the effects of a load on the ability to control a drone in the air as it moves to a simple target. • Calculate the maximum weight a drone is able to lift safely.	
	This practice will prepare pilots for the Lift and Load Badge Test.	• Test a lifting mechanism on a drone in flight. • Improve the design and build of a lifting mechanism on a drone. • Explore the effects of a load on the ability to control a drone in the air as it moves to a simple target. • Calculate the maximum weight a drone is able to lift safely	
	Pilots will be asked to demonstrate their flight skills on the lift and load course, successfully navigating each obstacle.	Badge Test • Record flight time in their flight log binders. • Maneuver the drone to pick up a payload, move it to another target location, and deliver it safely. • Communicate with team members effectively. • Land the drone in the same orientation in its original position.	
Advanced Skills Mission	This segment of flight training will challenge pilots to build advanced, complicated maneuvers to navigate obstacles.	• Improve flight and maneuverability skills by flying complicated pattern courses. • Acquire advanced flight control skills navigating elevation, direction, and heading changes.	
	Student pilots will continue flying the advanced flight patterns as they work toward mastering the maneuvers.	• Improve flight and maneuverability skills by flying complicated pattern courses. • Acquire advanced flight control skills navigating elevation, direction, and heading changes.	
	Pilots will practice the maneuvers over and over again to create the vision and muscle memory required for mastery.	• Improve flight and maneuverability skills by flying complicated pattern courses. • Acquire advanced flight control skills navigating elevation, direction, and heading changes.	
	Students are challenged to practice their pattern course skills within a time constraint.	• Improve flight and maneuverability skills by flying complicated pattern courses. • Acquire advanced flight control skills navigating elevation, direction, and heading changes. • Working toward a 30 second goal.	
	Student pilots will attempt to fly each advanced skills pattern in under 30 seconds without	Badge Test • Improve flight and maneuverability skills by flying	

Big Idea/Reporting Category	Concepts	Competencies/Eligible Content	Vocabulary
	stopping or crashing.	complicated pattern courses. • Demonstrate advanced flight control skills navigating elevation, direction, and heading changes.	
Drones in Modern Life	Students will explore how drone technology is being used globally and in a variety of industries around the world.	• Utilize a variety of digital literacy skills to acquire knowledge in modern drone use. • Write and speak articulately about the legal uses of drones and how laws are being shaped as the industry grows. • Formulate opinions on ethical issues and analyze social issues surrounding drones, aerial photography, and privacy.	Law Policy
	After determining that the conditions are appropriate for flight, they will perform the first maneuver in a three-maneuver challenge.	• Investigate how situational awareness impacts drone operation. • Explore how the law restricts the use of drones in national airspace.	
	Students will be challenged to understand an issue completely, form an opinion, then make a choice, and defend their choice using logic, fact, opinion, and sentiment.	• Investigate cultural issues related to drone use. • Formulate and defend positions on issues. • Communicate opinions using persuasive speaking and declarative statements.	
	Students will build and shape their own laws or new versions of existing laws that will guide general use policy.	• Investigate how the laws around drone use are being adapted quickly to fill the need generated by pilots across the world. • Practice writing laws regarding safe operation of drones for personal and professional use. • Write a law proposal in the correct language to be submitted to state or local government.	