

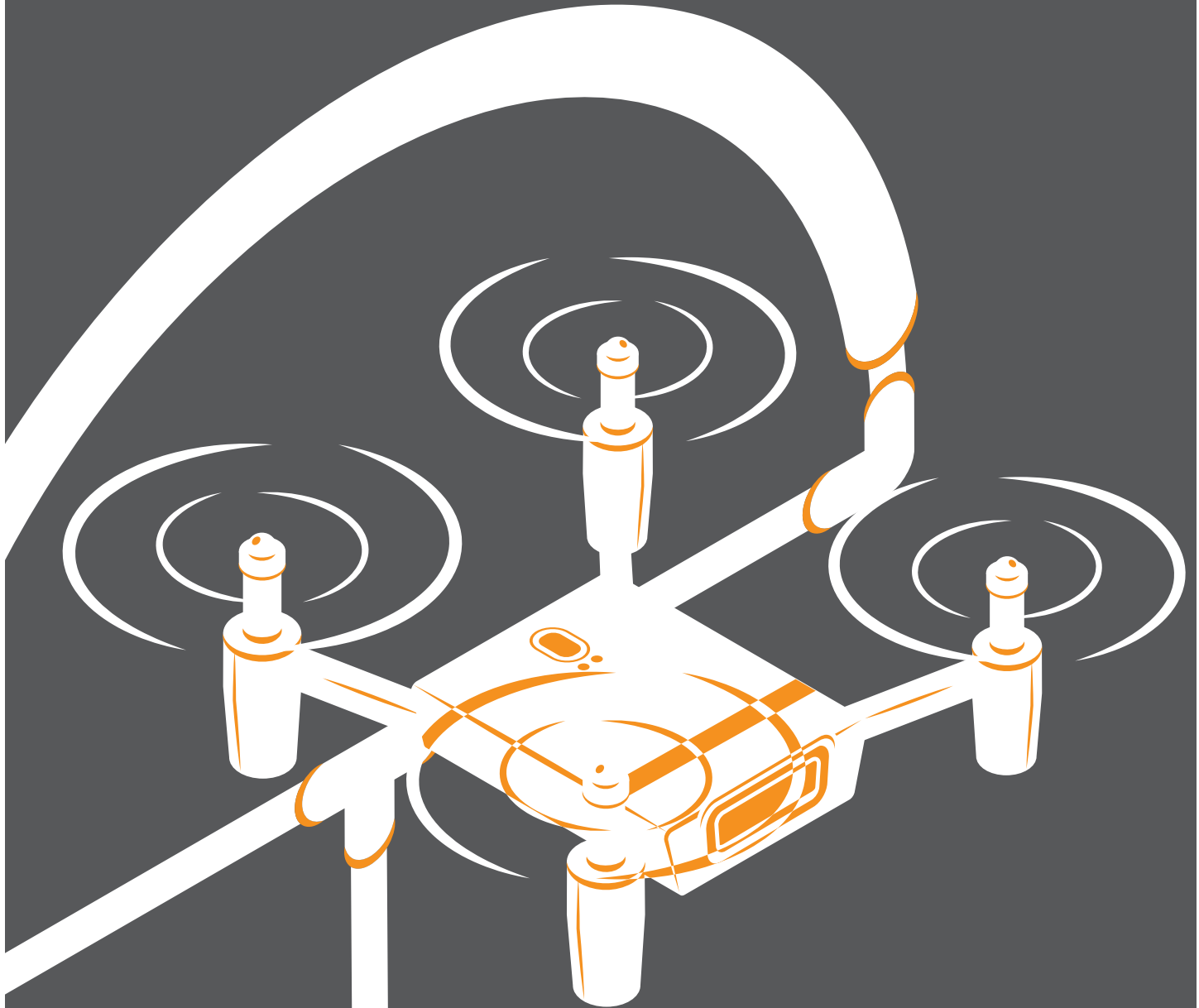


# 2024 Commercial sUAS (Drone) Competition

For Distribution



If you're interested in holding or participating in a SkillsUSA® drone competition, please complete the form found here:  
<https://my.crossflightkysolutions.com/2024skillsusa/>



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## INTRODUCTION

### Purpose

To evaluate team members' skills and preparation for employment in multiple career fields related to the safe and efficient use of drone technology in the National Airspace System and to recognize outstanding performance by participants in real-world, scenario-based situations.

### Competition Specifics

This document was created to provide general guidelines for those preparing/facilitating the Commercial sUAS Competition.

### Eligibility (team of 2)

#### Equipment and Materials

- Supplied by the contest facilitator:
  - Arena (20' x 20' x 10' and/or 30' x 30' x 15')
  - Field elements
  - Competition rubrics
  - Login information for online testing system
  - Awards
- Supplied by the team:
  - Fully assembled, tested, and operational drone with onboard camera (please see the Technical and Safety Guidelines on Page 9)
  - Fully charged batteries for drone
  - Laptop (one per student)
  - Eye protection (always required in the contest area)
  - One-page résumé per competitor that will be submitted as a hard copy to the Technical Committee chair during the debrief
  - Class E: Competition Specific – Business Casual dress
    - Official SkillsUSA® white polo shirt
    - Black dress slacks or black dress skirt (knee-length minimum)
    - Black closed-toe dress shoes

#### Skills/Competencies to Be Tested by the Contest

- Students can prove knowledge and understanding of FAA regulations.
- Students can safely plan and both manually and autonomously fly small unmanned aircraft system (sUAS; drone) equipment and collect usable data as required.
- Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.
- Students can demonstrate and document a valid sUAS operational cycle.
- Students can utilize knowledge and information to troubleshoot repairs for an sUAS.

#### Academic Skills Expected of Competitors in this Contest

Presentation and communication, programming and flowcharts, engineering design, technical literacy, critical thinking and problem-solving, spatial orientation, accessing and analyzing information, situational awareness, agility and adaptability, safety and social responsibility, environmental awareness, systems thinking, innovation and creativity, attention to detail, applied mathematics, applied science, emotional intelligence

#### Scope of the Contest

Student teams will be evaluated and scored in four tasks.

## Skill and Knowledge Performance

**Task 1: Flight Skills:** Student teams will need to be able to prove competency in the ability to operate sUAS in a safe and effective manner as a flight team and document appropriately. The teams will be given three scenarios and asked to plan, fly, collect data, communicate, and document based on industry-generated scenarios. Students should have a good understanding of how an sUAS operates and flies as well as all regulations and safety protocol and procedures. Students will be required to prove their skill and competency while flying on a live video feed, and designated school officials will be responsible for safety, protocols, and liability for all flights. It is a strong recommendation of the SkillsUSA committee that these flights be conducted indoors and inside a safe drone arena. Please see suggested flight scenario ideas attached to this document and reach out to the committee for help if needed.

**Task 2: sUAS Maintenance Troubleshooting and Repair:** Teams will be given scenarios and asked to solve industry-based problems and prove competency in the ability to troubleshoot and recommend corrective repairs common to sUAS. Students will need a detailed understanding of the mechanics of how drones operate, including the functionality of key components such as sensors, controls, and other technologies. This task will include multiple-choice questions, real-world scenarios, schematics, CAD renderings, and possible explanations required.

**Task 3: FAA Knowledge Test:** Each team member will be tested using FAA knowledge-based questions related to sUAS regulations. Each team member's score will be averaged together. The test will be proctored, and each student must take the test as an individual.

**Task 4: Autonomous Flight:** Students will be provided a mission scenario and will need to plan and explain all aspects of the flight as well as provide documentation showing calculations and decision-making strategies. Teams may use software of their choice but will need to be able to share results appropriately (for example, DroneDeploy, Pix4D, Litchi, or many others). Evaluation criteria will include but is not limited to effectiveness of mission accomplishment, flight plan efficiency, utilization of available power, cargo weight compensation, data-sharing capability, effective communication, and so on. This competition will be delivered and accepted through a full virtual platform, but pictures/scans of documents will be provided as well as other file uploads.

<b>S-1: Students can prove knowledge and understanding of FAA regulations.</b>	
Standard 1 Competencies	1.1 – Regulations
	1.2 – Airspace and requirements
	1.3 – Weather
	1.4 – Loading and performance
	1.5 – Operations
<b>S-2: Students can safely plan and both manually and autonomously fly sUAS (drone) equipment and collect usable data as required.</b>	
Standard 2 Competencies	2.1 – Professionalism for aviators in dress, attitudes, and all aspects of flight operations
	2.2 – Autonomous flight planning
	2.3 – Photogrammetry flight planning
	2.4 – Camera and other necessary sUAS settings
	2.5 – Part 107 regulations and operating requirements are met
	2.6 – Acceptable aviation communication during all aspects of flight tasks
	2.7 – Knowledgeable of GPS and GNSS location services, devices, and accuracies
	2.8 – Conduct environment mapping and event-related object searching
	2.9 – Locate objects and create archive according to mission plan
	2.10 – Detect obstacles and environmental hazards during mission execution
<b>S-3: Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.</b>	
Standard 3 Competencies	3.1 – Provide adequate information and planning for data that applies to personal privacy and data storage
	3.2 – Processing of photos for 2-D map and 3-D model
	3.3 – File-naming conventions
	3.4 – Delivery of data in a timely, acceptable, and understandable manner
<b>S-4: Students can demonstrate and document a valid sUAS operational cycle.</b>	
Standard 4 Competencies	4.1 – Preflight planning
	4.2 – Preflight briefing
	4.3 – Launch
	4.4 – Flight
	4.5 – Recovery
	4.6 – Debrief
<b>S-5: Students can demonstrate creative problem-solving abilities, data analysis skills, and the ability to adequately document their findings.</b>	
Standard 5 Competencies	5.1 – Documentation
	5.2 – Use a systematic approach to solve technical problems
	5.3 – Sketching skills
	5.4 – Work and communicate as part of a team
	5.5 – Flowcharts, pseudocode, and programming
	5.6 – Communicate technical information effectively

(Continued on the next page)

S-6: Students can utilize knowledge and information to troubleshoot repairs for an sUAS.	
Standard 6 Competencies	6.1 – Key airframe, hardware, processing, and sensing components of sUAS
	6.2 – Key interdependent components coordinate to enable operations
	6.3 – Wiring for correct polarity, location, and configuration
	6.4 – Flight controller orientation and wiring configuration
	6.5 – Propeller orientation, rotation, and configuration
	6.6 – Electronic speed controller (ESC) polarity and orientation
	6.7 – Structural, battery, and other damage from operations
	6.8 – Arming the sUAS for flight mode
	6.9 – sUAS improper response to transmitter stick movements
	6.10 – Pitch or roll drifting during flight
	6.11 – Oscillations (lack of stability) during flight
	6.12 – sUAS veering off GPS coordinate flight path

# Commercial sUAS (Drone) Competition Rubric

Team No.: \_\_\_\_\_ Date: \_\_\_\_\_ Judge No.: \_\_\_\_\_

<b>Task 1: Flight Skills - 250 points</b>	
<b>Standard 2</b>	<b>Students can safely plan and both manually and autonomously fly sUAS (drone) equipment and collect usable data as required.</b>
	2.1 – Professionalism for aviators in dress, attitudes, and all aspects of flight operations
	2.4 – Camera and other necessary sUAS system settings
	2.5 – Part 107 regulations and operating requirements are met
	2.6 – Students use acceptable aviation communication during all aspects of flight tasks.
	2.8 – Conduct environment mapping and event-related object searching
	2.9 – Locate objects and create archive according to mission plan
	2.10 – Detect obstacles and environmental hazards during mission execution
<b>Standard 3</b>	<b>Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.</b>
	3.4 – Delivery of data in a timely, acceptable, and understandable manner
<b>Standard 4</b>	<b>Students can demonstrate and document a valid sUAS operational cycle.</b>
	4.1 – Preflight planning
	4.2 – Preflight briefing
	4.3 – Launch
	4.4 – Flight
	4.5 – Recovery
	4.6 – Debrief

**Flight Scenario 1:** The objective of this flight scenario is to find hidden objects. Team communication is necessary for successful completion of this scenario. These objects can be under, between, or on top of some structure or object. The object has an indicator, such as number or colored sticker, that the drone has to be able to photograph and relay to the drone operator. This indicator corresponds to a landing pad that the operator must then navigate the drone to and land on.

**Flight Scenario 2:** The objective of this flight scenario is to identify specific objects mixed in with similar objects (for example, with two different colors of foam balls, the pilot must identify the colors while knocking each colored ball off of a stand). The drone will need to inspect and locate each object, based on the requested sequence outlined by the competition facilitator.

**Flight Scenario 3:** The objective of this flight scenario is to fly to an object that is at least six feet tall. The course includes multiple landing pads (at least three). Each of these landing pads has a different difficulty level. Each landing pad has a small target with at least three concentric circles. Flight skills are proven based on the pilot's ability to land the drone on less accessible landing pads, on smaller landing pads, and centered on the landing pads.

**See Page 11 for visuals of the suggested field elements.**

## Commercial sUAS (Drone) Competition Rubric

<b>Task 2: sUAS Maintenance Troubleshooting and Repair - 250 points</b>	
<b>Standard 6</b>	<b>Students can utilize knowledge and information to troubleshoot repairs for an sUAS.</b>
	6.1 – Key airframe, hardware, processing, and sensing components of sUAS
	6.2 – Key interdependent components coordinate to enable operations
	6.3 – Wiring for correct polarity, location, and configuration
	6.4 – Flight controller orientation and wiring configuration
	6.5 – Propeller orientation, rotation, and configuration
	6.6 – Electronic speed controller (ESC) polarity and orientation
	6.7 – Structural, battery, and other damage from operations
	6.8 – Arming the sUAS for flight mode
	6.9 – sUAS improper response to transmitter stick movements
	6.10 – Pitch or roll drifting during flight
	6.11 – Oscillations (lack of stability) during flight
	6.12 – sUAS veering off GPS coordinate flight path

<b>Task 3: FAA Knowledge Test - 230 points</b>	
<b>Standard 1</b>	<b>Students can prove knowledge and understanding of FAA regulations.</b>
	1.1 – Regulations
	1.2 – Airspace and requirements
	1.3 – Weather
	1.4 – Loading and performance
	1.5 – Operations



# Commercial sUAS (Drone) Competition Rubric

<b>Task 4: Autonomous Flight - 245 points</b>	
<b>Standard 1</b>	<b>Students can prove knowledge and understanding of FAA regulations.</b>
	1.1 – Regulations
	1.2 – Airspace and requirements
	1.3 – Weather
	1.4 – Loading and performance
	1.5 – Operations
<b>Standard 2</b>	<b>Students can safely plan and both manually and autonomously fly sUAS (drone) equipment and collect usable data as required.</b>
	2.2 – Autonomous flight planning
	2.3 – Photogrammetry flight planning
	2.4 – Camera and other necessary sUAS system settings
	2.5 – Part 107 regulations and operating requirements are met
	2.6 – Students use acceptable aviation communication during all aspects of flight tasks.
	2.7 – Students are knowledgeable of GPS and GNSS location services, devices, and accuracies.
	2.8 – Students can conduct environment mapping and event-related object searching.
<b>Standard 3</b>	<b>Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.</b>
	3.1 – Students can provide adequate information and planning for data that applies to personal privacy and data storage.
	3.2 – Processing of photos for 2-D map and 3-D model
	3.3 – File-naming conventions
	3.4 – Delivery of data in a timely, acceptable, and understandable manner
<b>Standard 4</b>	<b>Students can demonstrate and document a valid sUAS operational cycle.</b>
	4.1 – Preflight planning
	4.2 – Preflight briefing
	4.3 – Launch
	4.4 – Flight
	4.5 – Recovery
	4.6 – Debrief

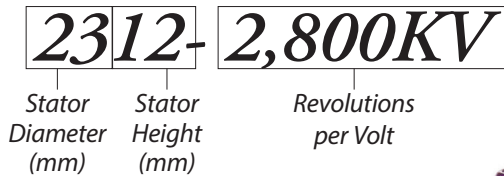
<b>SkillsUSA Professional Development Test - 25 points</b>	
	<b>SkillsUSA Professional Development Test</b>
	Team Score

## Technical and Safety Guidelines

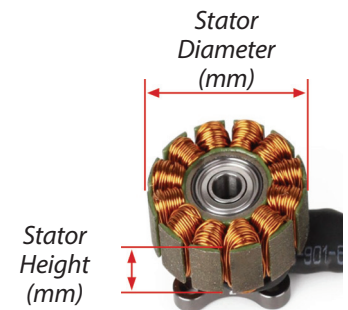
**Airframe:** There are no limitations regarding the design of the sUAS airframe; small, medium, large sizes as well as different shapes and configurations are all welcome. Please refer to page 11 for dimensions of the field elements to ensure your drone can maneuver through the course. Drones heavier than 3.5 pounds are not permitted in the competition unless special permission is granted.

**Number of Rotors:** There are no limitations to the number of rotors that may be employed on the sUAS airframe.

**Maximum Motor Power:** Any brand motor is welcome to be used so long as it has a can size no greater than 2312 (size of magnetic stator in millimeters) and power of 2,800 kV (1,000 rpm per volt). Both can size and power should be etched on the outside of the motor housing. If it is not listed on the motor, please bring the motor manufacturer's specifications with you to the competition; these are typically found on the manufacturer's website. See the following diagrams for more information.



The combination of the motor's stator *diameter* and *height* determine its maximum torque value. The motor should be labeled with this information as in the image to the left.



**Propeller Safety:** Fingers, face, hair, clothing, and other bodily objects must be kept away from the propellers at all times. Safety glasses must be worn any time a propeller is in operation.

**Safety Guards:** Each rotor, no matter how many have been employed, must be protected and enshrouded by a safety guard that is capable of keeping the outside edge of the propeller from making contact with anything while in operation.

**Safety Glasses and Harmful Objects:** Safety glasses must always be worn inside and around the field of play. No sharp objects or drone appendages that could potentially cause harm or damage to a person, objects, or playing field are allowed.

**Drone and Controller Device:** The drone must be capable of taking photographs and the contestant must be able to immediately show the judges the photos at the completion of their task on a display screen. No post-processing of images is allowed. Additionally, the pilot is the contestant who must take the photos.

**Connectivity:** Controllers that utilize Wi-Fi might experience interference issues within Wi-Fi-dense environments, such as large convention centers. Contestants should be aware that Wi-Fi controllers may work fine in some settings and not in others. It is the responsibility of the contestants to be prepared in situations where Wi-Fi interference occurs. The host facilitators will not be providing alternate drones for contestants.

**FPV Equipment:** If a contestant utilizes FPV equipment, it must be commercially produced and must be FCC certified without need for a ham radio license.

**Minor Violations:** The contest judges will assign minor violations if an infraction occurs. They may assign additional violations, which have not been listed, per their discretion, related to sportsmanship, integrity, respect, safety, and so on. A first minor violation is a written warning, a second minor violation is a 50-point deduction, and a third minor violation is team disqualification.

**Major Violations:** If any major violation occurs, putting oneself or others' safety at risk, the contest judges also have the authority to disqualify a team for that infraction. **NEVER OPERATE sUAS OUTSIDE OF THE EVENT CENTER OR COMPETITION COURSE AS DOING SO WILL RESULT IN IMMEDIATE TEAM DISQUALIFICATION.**

### Videos

Video explanations for this competition can be found here: <http://my.crossflightkysolutions.com/2024skillsusa/>

Competition Overview

LMS Directions

Competition Safety Video

Task 1 Description

Task 2 Description

Task 3 Description

Task 4 Description

**National Competition:** As a reminder, this Guidebook is focused on the National Competition. Each individual state may choose to adjust the event as they desire. The Competition Committee has outlined numerous safety specifications in the Guidebook, with hopes the states will ensure the same level of student safety.

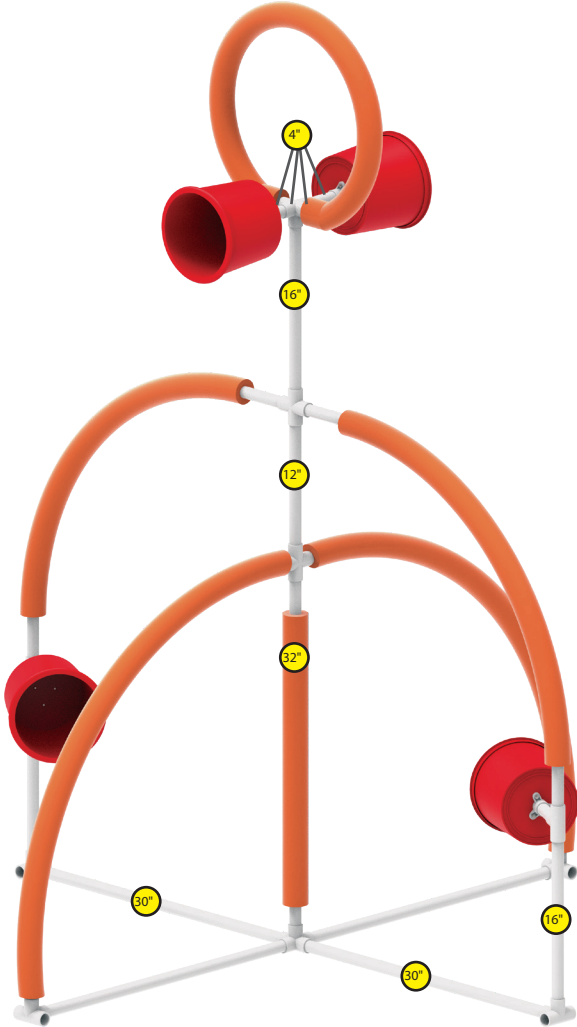
## Learning Management System (LMS)

As a part of the Commercial sUAS (Drone) Competition, certain tasks can be scored through an online learning management system (LMS). Access to the LMS can be available for all states that are planning a competition. Included in the LMS will be:

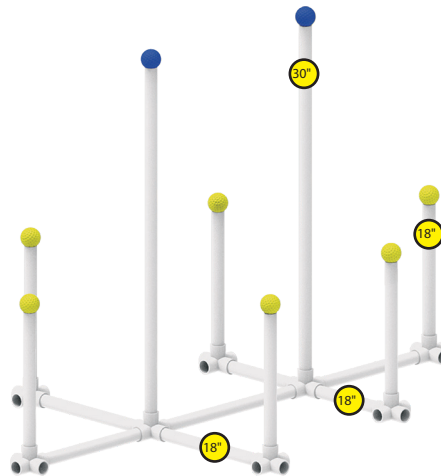
- Directions for use, portals for submissions, and assessments for all tasks being evaluated.
- Early access to information about requirements that may be shared with participants and schools (including video tutorials).
- Access for competition facilitator for scoring and viewing of submitted requirements.

## Field Element Examples

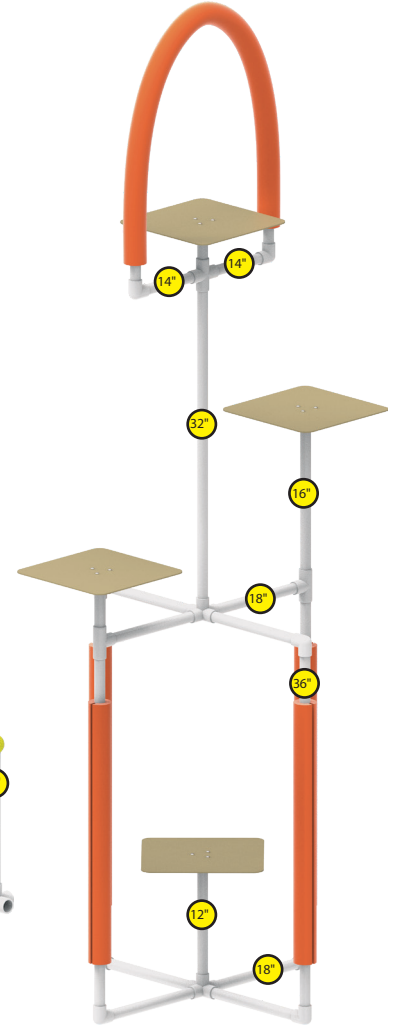
### Flight Scenario 1 Example



### Flight Scenario 2 Example



### Flight Scenario 3 Example



## Links to SkillsUSA Components

Drone (Pitsco): <https://www.pitsco.com/DJI-Mini-3-Pro-Drone>

Drone (MINDS-i): <https://mindsieducation.com/collections/competition-gear>

Field Elements: <https://www.pitsco.com/Drone-Industry-Field-Elements-Kit>

Arenas: <https://www.pitsco.com/Drone-Arena-10-x-20> and <https://www.pitsco.com/Drone-Arena-20-x-20>

FAA Testing Supplemental: <https://www.pitsco.com/FAA-Testing-Supplemental>



**HAVE QUESTIONS?**  
Email us at [skillsdrones@pitsco.com](mailto:skillsdrones@pitsco.com).

