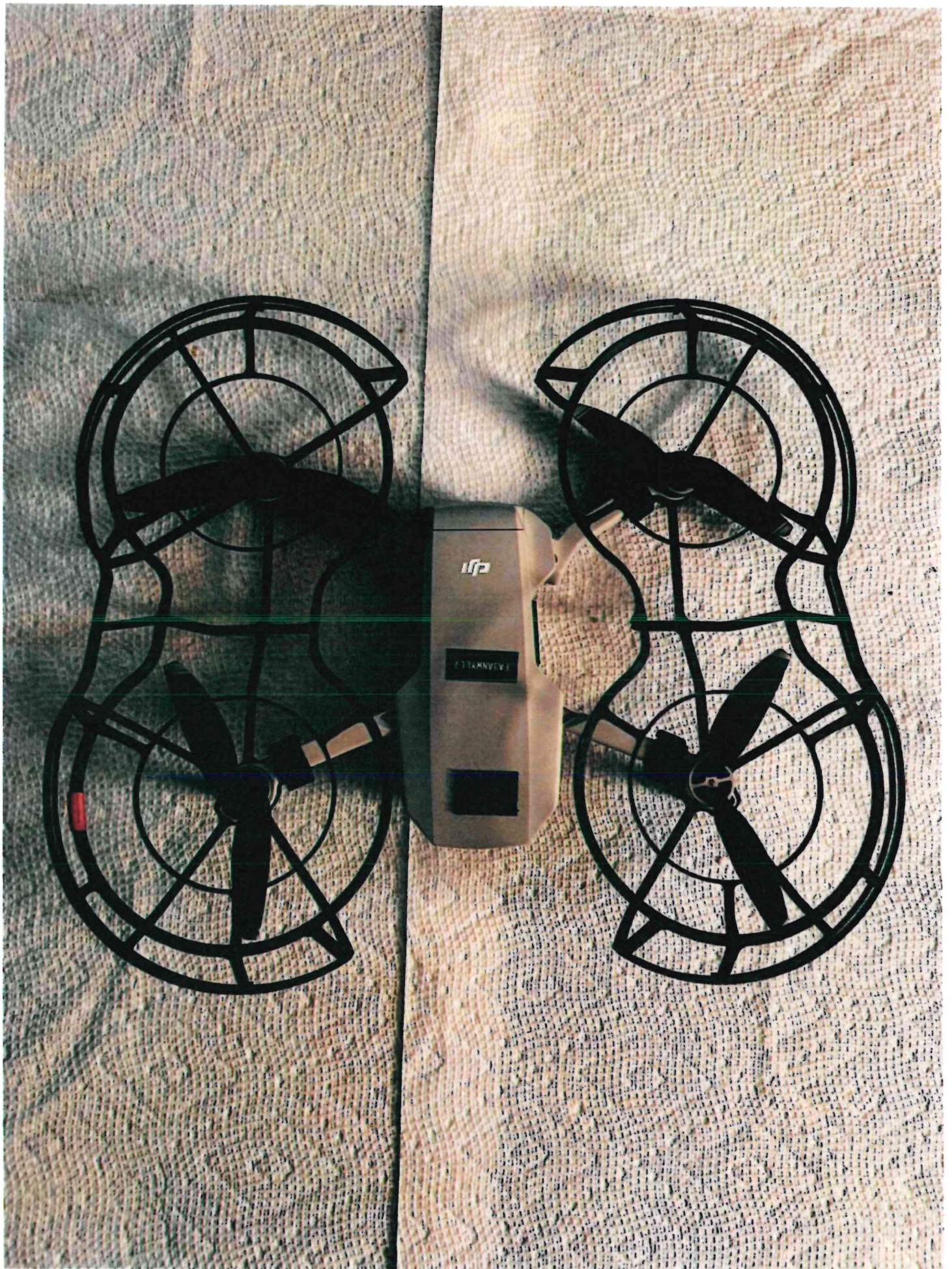# Commercial sUAS Drone

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.

On-Site/Off-Site	• On-Site
Contest Date	• 3/18/2025
Contest Location	• Convention Center • A-Hall
Early/Normal Start Time	• Normal Start Time • Registration will be at 9:00am • Orientation begins at 9:30am.
Contest Open/Closed	• Closed • Exhibit Halls do not open to observers until 12:00pm.
Eligibility & Contest Type	• Please refer to the Program Guidelines for eligibility- https://www.ohioskillsusa.org/resources/ • Straight to State Contest (No Regional Qualifier)
Clothing	• **For Competition Day the Dress Code is:** Class D • **For the Awards Ceremony the Dress Code is:** Class A or Class J • **2025 SkillsUSA Ohio Clothing Guide**
Safety Equipment Required	• Safety glasses with side shields or goggles (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles).
Testing	• Series of Psycho Motor Skills testing, oral interview, a Computerized FAA exam, and a Maintenance/Troubleshooting exam will be part of the contest.

Provided by Contestant (Tool List)	- Contestant Teams are NOT AUTHORIZED to share equipment with other teams - Laptop - Fully assembled, tested, and operational drone with onboard camera. Capable of recording images either through a Miros SD card, hard drive in the drone or through the monitor/controller. - Drone must be capable of operating inside the Convention Center. - Drone must be capable, with prop guards or cages attached, of passing through a possible obstacle 20 inches high x 29 inches wide and landing in 12-inch landing pad. - REQUIRED – Drone must be equipped with Prop Guards or Prop Cages to protect the propellers and all persons in the area while operating inside the convention center and completion area. This requirement is not negotiable, drone must be equipped with prop guards or prop cages (please see attached photo). If the drone is not equipped with either, then the team may not compete in the drone completion. This is a safety requirement. - Strobe light that can mount on the drone. - Controller Monitor or tablet (no internet hookup will be permitted) - Extra accessories, props, cables, extra batteries. - Carrying case - NOTE: One of the scenarios the pilot may have to use the drone to dislodge an item. Therefore, a bumper or push bar mounted on the drone, extending out from the front of the drone will be needed. A 3D printed bumper or push bar attached to the drone will be acceptable for use in the competition. - Pilot Logbook - Flights will need to be logged just like a real mission/operation would be - Safety Vest - Signed and completed medical form - Eye Protection (safety glasses/goggles of some sort or prescription glasses with side shields)
Contest Notes, Themes, & Deadlines	- Contest will begin as soon as orientation has been completed. Contestants should be at the contest no later 9:30am. ***Contestants arriving after 10:00 a.m. will result in an automatic disqualification.*** - Each contestant will be given a checklist of workstations. Each contestant will rotate through and complete each scenario/workstation. - Each contestant will be scored by each individual workstation judge(s). If the workstation requires photographs to be taken by the drone, data must be either on a Micro SD card or hard drive in the drone or controller/monitor/tablet. The Micro SD card or

	drone, controller/monitor/tablet will be made available for downloading of the photographs. • Failure to bring required equipment will result in a reduction in scoring.
WIFI Provided?	• Yes
Special Notes/Rules for All Contests	• Started in 2024, all Skilled Trade State Contests (most leadership contests already use scenarios) will begin to add a scenario-based component. • **Wi-Fi will NOT BE AVAILABLE unless listed above** . If you need WIFI access please plan to bring a hotspot. • All safety requirements will be heavily enforced. Competitors are to follow all safety standards and OSHA Regulations • *Contestants MUST HAVE A COPY OF THEIR EMERGENCY MEDICAL FORM IN THEIR NAME BADGE AT ALL TIMES* • **THE FOLLOWING ITEMS ARE PROHIBITED; VIOLATION OF ANY OF THE FOLLOWING MAY RESULT IN COMPETITOR DISQUALIFICATION:** • Contact with Contest Coordinators is prohibited. Contact with Contest Coordinators outside of the SkillsUSA Ohio is strictly prohibited. • Possession of smart watches and/or phones during the contest and/or in contest. • Contact with anyone outside of the contest area once the contest begins. • Inappropriate communication between contestants such as verbally degrading another contest. • Cheating on any portion of the contest such as informing another contestant of the skills/test prior to competing. • Lack of Copy Emergency Medical Form in Name Badge.
National Technical Standards	• Please refer to the **2024-2026 National Technical Standards** for all contests. All standards included may be tested in any competition. • In conjunction with National Standards, lack of understanding of State Level competition standards (this document) may result in student loss of contest.
Resume/Interview Requirement	• All SkillsUSA Ohio State Championship Contests will require a short interview component. Students should be prepared with basic job interview skills. • All contestants **must have a hard copy** of a one (1) page personal resume.

If you're interested in holding or participating in a SkillsUSA®
drone competition, please complete the form found here:
https://my.crossflightskysolutions.com/2024skillsusa/
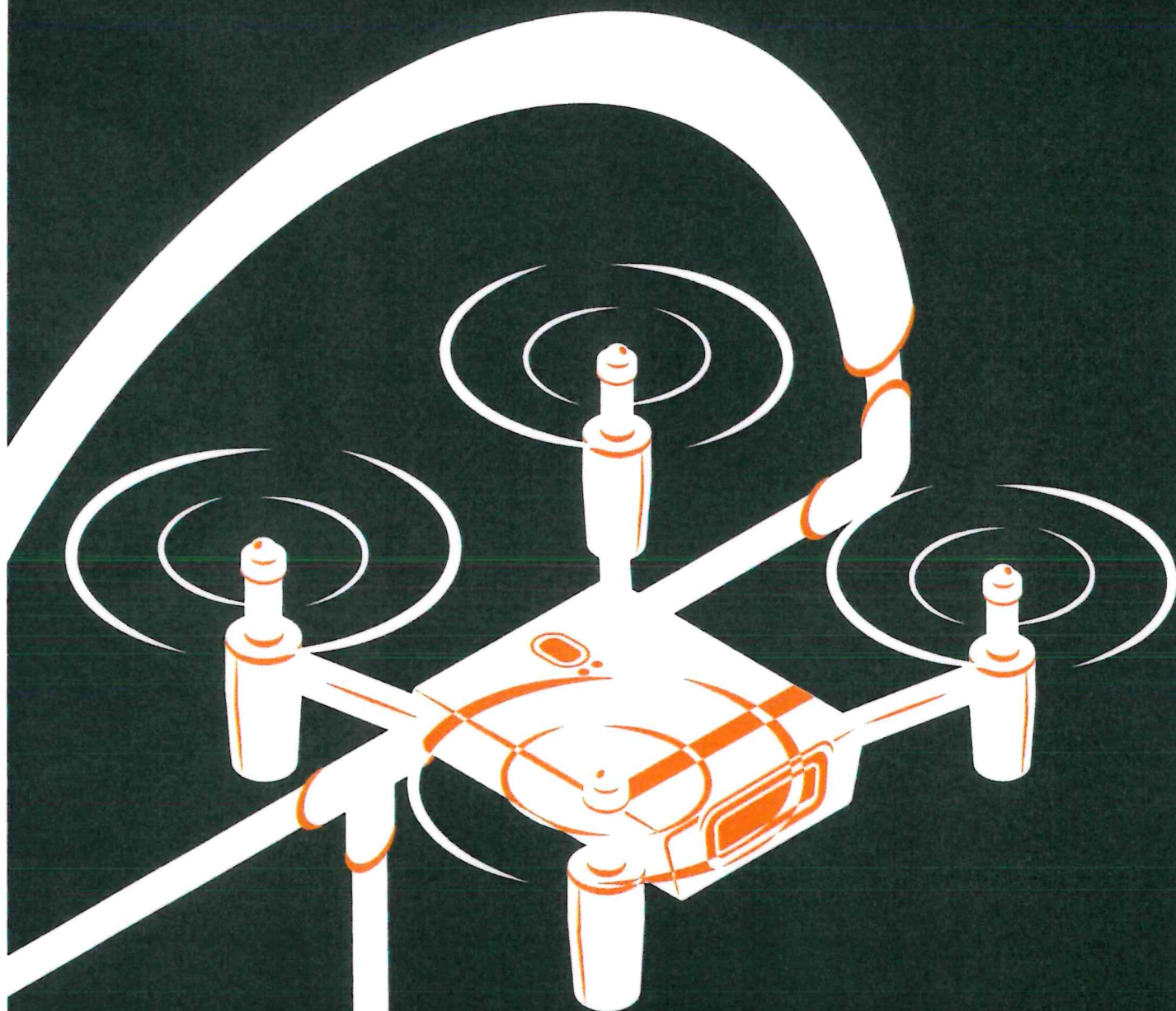
National Education Team Members:

Nancy Ruzycki

Linda Stinson

v1.4
08/24

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.

Commercial sUAS (Drone) Competition Standards 2024

	S-1: Students can prove knowledge and understanding of FAA regulations.
Standard 1 Competencies	1.1 – Regulations
	1.2 – Airspace and requirements
	1.3 – Weather
	1.4 – Loading and performance
	1.5 – Operations

	S-2: Students can safely plan and both manually and autonomously fly sUAS (drone) equipment and collect usable data as required.
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

	S-3: Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.
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

	S-4: Students can demonstrate and document a valid sUAS operational cycle.
Standard 4 Competencies	4.1 – Preflight planning
	4.2 – Preflight briefing
	4.3 – Launch
	4.4 – Flight
	4.5 – Recovery
	4.6 – Debrief

	S-5: Students can demonstrate creative problem-solving abilities, data analysis skills, and the ability to adequately document their findings.
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.: _____

	Task 1: Flight Skills - 250 points		
	Students can safely plan and both manually and autonomously fly sUAS (drone) equipment and collect usable data as required.		
Standard 2	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		
Standard 3	**Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.**		
	3.4 – Delivery of data in a timely, acceptable, and understandable manner		
Standard 4	**Students can demonstrate and document a valid sUAS operational cycle.**		
	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.

Task 2: sUAS Maintenance Troubleshooting and Repair - 250 points	
	Students can utilize knowledge and information to troubleshoot repairs for an sUAS.
Standard 6	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

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

Task 4: Autonomous Flight - 245 points

Standard 1	**Students can prove knowledge and understanding of FAA regulations.**	
	1.1 – Regulations	
	1.2 – Airspace and requirements	
	1.3 – Weather	
	1.4 – Loading and performance	
	1.5 – Operations	
Standard 2	**Students can safely plan and both manually and autonomously fly sUAS (drone) equipment and collect usable data as required.**	
	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.	
Standard 3	**Students can store, organize, and deliver/communicate data in an acceptable manner based on industry standards.**	
	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	
Standard 4	**Students can demonstrate and document a valid sUAS operational cycle.**	
	4.1 – Preflight planning	
	4.2 – Preflight briefing	
	4.3 – Launch	
	4.4 – Flight	
	4.5 – Recovery	
	4.6 – Debrief	

SkillsUSA Professional Development Test - 25 points

| |
|---|
| **SkillsUSA Professional Development Test** |
| 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.

$$\boxed{23}\boxed{12}\text{-}\boxed{2,800KV}$$

Stator Diameter (mm) Stator Height (mm) Revolutions per Volt
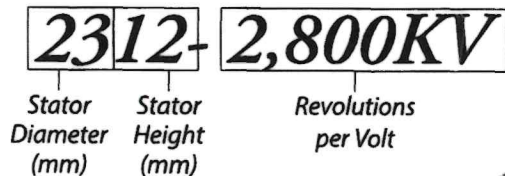
Stator Diameter (mm)

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.

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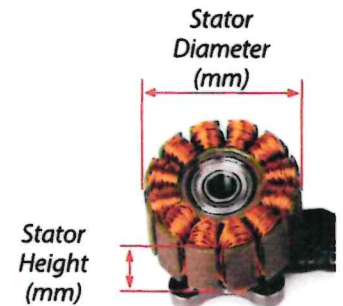
Propeller Safety: Fingers, face, hair, clothing, and other bodily objects must be kept away from the propellers at all times. Safety glasses must be worn any time a propeller is in operation.

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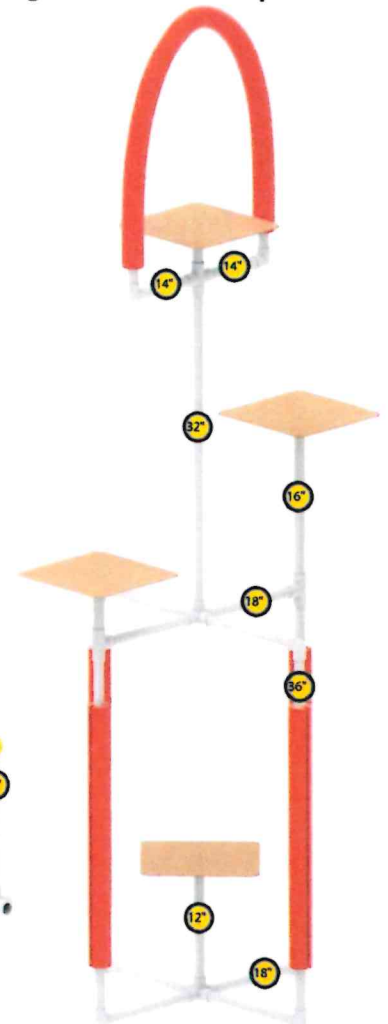
- Directions for use, portals for submissions, and assessments for all tasks being evaluated.
- Early access to information about requirements that may be shared with participants and schools (including video tutorials).
- Access for competition facilitator for scoring and viewing of submitted requirements.
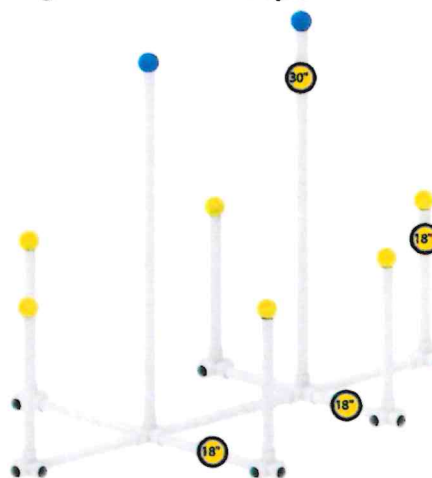
Field Element Examples

Flight Scenario 1 Example
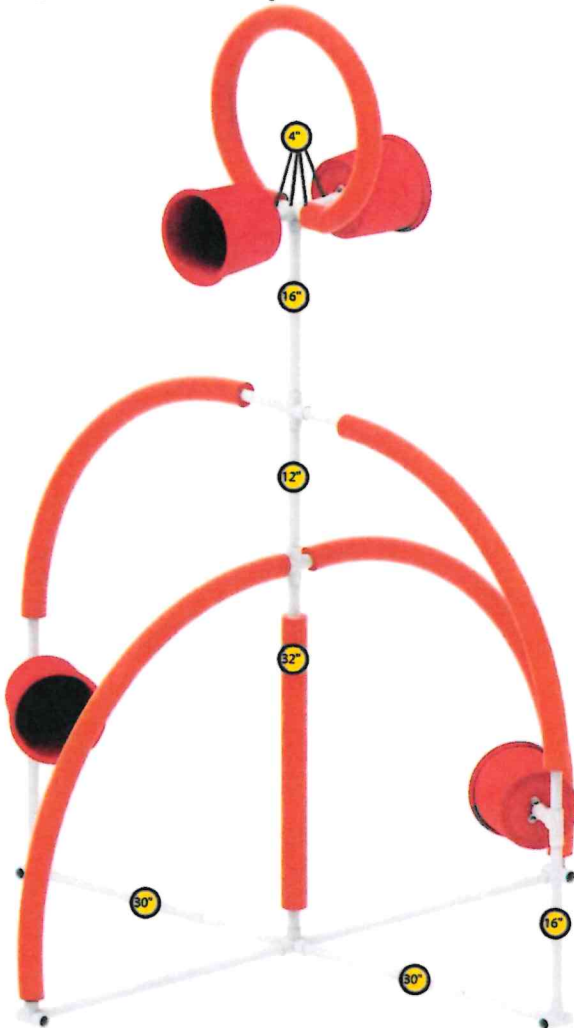
Flight Scenario 3 Example

Flight Scenario 2 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