



COMMERCIAL sUAS DRONE



SkillsUSA Championships Technical Standards

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.

ELIGIBILITY (TEAM OF TWO)

Open to active SkillsUSA members enrolled in career and technical programs with drone technology as an occupational objective.

CLOTHING REQUIREMENT

Class E: Competition Specific — Business Casual

- Official SkillsUSA white polo shirt
- Black dress slacks or black dress skirt (knee-length minimum)
- Black closed-toe dress shoes

Note: Wearing socks or hose is no longer required. If worn, socks must be black dress socks and hose must be either black or skin-tone and seamless/nonpattern.

These regulations refer to clothing items that are pictured and described at www.skillsusastore.org. If you have questions about clothing or other logo items, call 1-888-501-2183.

Note: Competitors must wear their official competition clothing to the competition orientation meeting.

EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
 - a. Arena
 - b. Field elements
 - c. Judges' sheets
 - d. Team identifier stickers
2. Supplied by the competitors:
 - a. Fully assembled, tested, and operational drone with onboard camera
 - b. Eye protection (always required in the competition area)
 - c. Computer and video equipment
 - d. 6' multiple outlet surge protector
 - e. All competitors must create a one-page resume. See "Resume Requirement" below for guidelines.

RESUME REQUIREMENT

Competitors must create a one-page resume to submit online. SkillsUSA national competitors should submit their resume by June 1. The link for resume submission will be published on <http://updates.skillsusa.org> on May 1. Failure to submit a resume will result in a 10-point penalty.

Your resume must be saved as a PDF file type using file name format of "Last Name_First Name." For example, "Amanda Smith" would save her resume as **Smith_Amanda**. If you need assistance with saving your file as a PDF, visit [the Adobe website](#) for more information.

Note: Check the Competition Guidelines and/or the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

PROHIBITED DEVICES

Cell phones or other electronic devices not approved by a competition's national technical committee are **NOT** allowed in the competition area. Please follow the guidelines in each technical standard for approved exceptions. Technical committee members may also approve exceptions onsite during the SkillsUSA Championships if deemed appropriate.

Penalties for Prohibited Devices

If a competitor's electronic device makes noise or if the competitor is seen using it at any time during the competition, an official report will be documented for review by the SkillsUSA Championships director. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor's scores may be canceled.

SCOPE OF THE COMPETITION

KNOWLEDGE PERFORMANCE

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 for a total written test score. The test will be proctored, and each student must take the test as an individual. Competitors are also required to take the SkillsUSA professional development test.

SKILL PERFORMANCE

Student teams will be evaluated and scored in four tasks:

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. Flights will be conducted indoors and inside of a safe drone arena.

Task 2: sUAS Maintenance Troubleshooting and Repair

Teams will be given virtual 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. All portions of this task will be given in a virtual format including multiple-choice questions, real-world scenarios, schematics, CAD renderings, and possible explanations required.

Task 3: FAA Knowledge Test: see details in knowledge performance section.

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 are 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.

COMPETITION GUIDELINES

- Teams must be composed of two students.
- All teams are expected to adhere to the official rules for the drone competition.
- Teams are required to utilize their own computer, drone and video equipment.
- Teams are expected to practice and become proficient at the skills listed in the competition standards.

Note: Drones that use a 2.4 GHz Wi-Fi connection (such as the DJI Tello drone) could experience Wi-Fi interference in locations with extremely high rates of Wi-Fi signal.

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. 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. The information is typically found on the manufacturer's website.

Propeller Specifications: Propellers with a maximum length of 5 inches with a blunt edge are allowed in the sUAS competition. Fingers, face, hair, clothing, and other bodily objects must be always kept away from the propellers. 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.

Containment Arena: If the host location does not utilize a containment arena, then no additional students should be permitted in the competition area during flight. All adults in the area must always wear safety glasses.

Minor Violations: The competition judges will assign minor violations as specified if an infraction occurs. They may assign additional violations, which have not been listed, per their discretion, related to sportsmanship, integrity, respect, safety, etc. A first minor violation is a

written warning, a second minor violation is a 50-point deduction, and a third minor violation may result in a team disqualification.

Major Violations: The competition judges also have the authority and discretion to disqualify a team for any single major violation that relates to putting others' safety at risk. Never operate sUAS outside of the event center or competition course as doing so will result in immediate team disqualification.

LINKS TO SKILLSUSA COMPONENT RESOURCES:

- Drone (Pitsco): <https://www.pitsco.com/Tello-EDU-Drone-5-Pack>
- 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>
- Video explanations for the competition: <http://my.crossflightskysolutions.com/2022skillsusa/>

STANDARDS AND COMPETENCIES

DT 1.0 — 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

DT 2.0 — Safely plan and both manually and autonomously fly small, unmanned aircraft system (sUAS; drone) equipment and collect usable data as required.

- 2.1. Manual flight with team communications
- 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. 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
- 2.9. Students can acquire and relocate objects
- 2.10. Students can perform detection avoidance of acquired objects

DT 3.0 — 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 acceptable and understandable manner

DT 4.0 — Demonstrate and document a valid sUAS operational cycle.

- 4.1. Pre-flight planning
- 4.2. Pre-flight briefing
- 4.3. Launch
- 4.4. Flight
- 4.5. Recovery
- 4.6. Debrief

DT 5.0 — Utilize knowledge and information to troubleshoot repairs for an sUAS.

- 5.1. Key airframe, hardware, processing, and sensing components of sUAS
- 5.2. Key interdependent components coordinate to enable operations
- 5.3. Wiring for correct polarity, location, and configuration
- 5.4. Flight controller orientation and wiring configuration
- 5.5. Propeller orientation, rotation, and configuration
- 5.6. Electronic speed controller (ESC) polarity and orientation
- 5.7. Structural, battery, and other damage from operations
- 5.8. Arming the sUAS for flight mode
- 5.9. sUAS improper response to transmitter stick movements
- 5.10. Pitch or roll drifting during flight
- 5.11. Oscillations (lack of stability) during flight
- 5.12. sUAS veering off GPS coordinate flight path

DT 6.0 — Demonstrate ability to utilize the design process and accurately document the design process in an engineering notebook.

- 6.1. Documentation in engineering notebook
- 6.2. Use a systematic approach to solve technical problems
- 6.3. Sketching skills
- 6.4. Work and communicate as part of a design/build team
- 6.5. Flowcharts, pseudocode, and programming
- 6.6. Communicate technical information effectively (presentation and portfolio)

DT 7.0 — SkillsUSA Framework

The SkillsUSA Framework is used to pinpoint the Essential Elements found in Personal Skills, Workplace Skills, and Technical Skills Grounded in Academics. Students will be expected to display or explain how they used some of these essential elements. Please reference the graphic above, as you may be scored on specific elements applied to your project. For more, visit: www.skillsusa.org/about/skillsusa-framework/.



COMMITTEE IDENTIFIED ACADEMIC SKILLS

- 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