



## **Commercial sUAS (Drone) Competition Team Guide**

**April 2022**

**Note:** Event rules/regulations are subject to revision prior to competition

## Event

The **2022 Drone Technology**: Drone skills, enables students to enter a wide range of industries using this new field of technology. Drones are cost effective, safer, faster and more accurate than traditional methods of aerial data acquisition. Additionally, with the pending integration of drones into the national airspace, this platform, helps multiple industries leverage autonomous drone operations and redefines their business models. The field of precision agriculture is benefiting farmers greatly by providing actionable data into crop health, yields and other cost-saving measures. This platform, allows drone operators equipped with special imaging sensors to fly optimized autonomous mapping flight plans over farmland to generate insightful useful maps. In construction and surveying, drones are increasingly being utilized to scan job sites and create photo-realistic 3D maps of terrain and structures with centimeter-grade accuracy. This enables construction professionals' greater intelligence through timely asset tracking, surveying, 3D modeling, site planning and much more. The energy industry is perpetually gathering information for risk management, from pipeline monitoring to encroaching trees and foliage on transmission lines. Drones give users the ability to gather aerial imagery in a timely, safe and cost-effective manner, thus helping to identify potential crisis like spills and outages. The usage of drones in the mining industry is limitless and increasingly becoming an invaluable resource. Drone operators and end-users

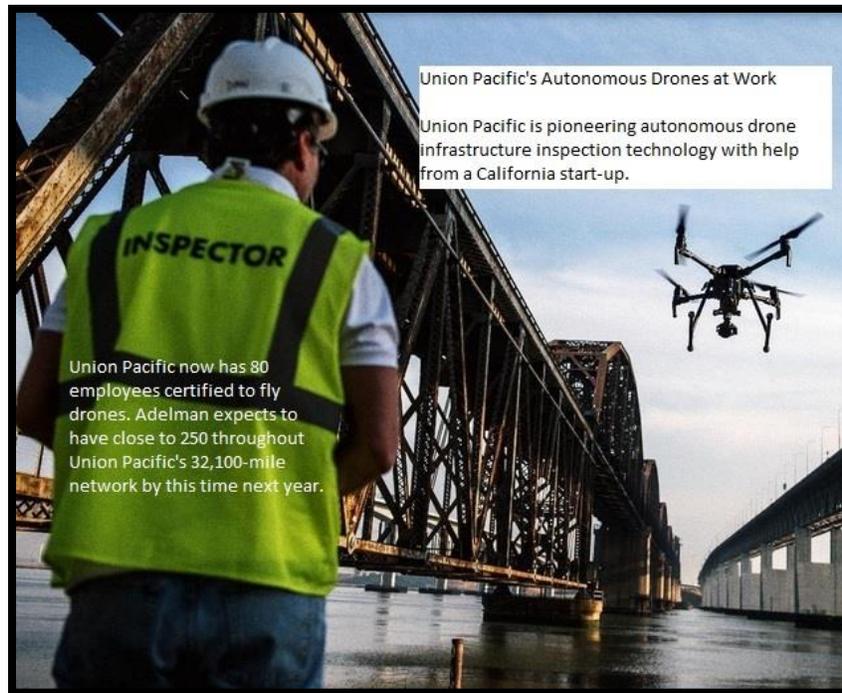
have the ability to monitor stockpiles, map exploration targets and track equipment at the fraction of the cost of a helicopter, but in a much safer manner. Photogrammetry, the science of making measurements from photographs, pertains to mapping the earth and with the recent explosion of consumer drone technology; photogrammetry by GPS-enabled drones is increasingly becoming the norm.

Competition evaluates 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.

CrossFlight Sky Solutions, MINDS-i Robotics, Pitsco Education, and the University of Florida's Herbert Wertheim College of Engineering worked closely together to develop the new competition that can be conducted in person or virtually in 2021, enabling student participants to experience real-world, scenario-based situations involving small unmanned aircraft systems (sUAS), also known as drones.

"SkillsUSA's new Commercial sUAS (Drone) Competition is a perfect example of how education and industry can work together to create compelling new opportunities for our students in some of the nation's fastest-growing fields," said SkillsUSA Executive Director Chelle Travis.

“SkillsUSA is proud and excited to add this competition to the more than 100 skilled competitions we’ve already created in cooperation with our varied industry partners.



Commercial sUAS (Drone) Competition engages students in exciting real-life scenarios while teaching them the hands-on technology, maintenance, and piloting skills needed to successfully pursue a career in sUAS,” said MINDS-i Robotics President Mike Marzetta.



**Purpose:**

To evaluate team members' skill and preparation for employment in fields related to and including drones,

engineering, automation, manufacturing, electronics, computers and emergency services.

To recognize outstanding performance by participants in scenarios that require problem solving and teamwork in the real-world situation.

**Clothing Requirement:**

Official SkillsUSA attire is required. For complete details, visit [www.skillsusastore.org](http://www.skillsusastore.org). If you have questions about clothing or logo attire, call 800-401-1560 or 703-956-3723

**Eligibility:** The Drone challenge is open to active SkillsUSA members.

**Supplied by Technical Committee:**

**Challenge field** Team must go through

Basic = Field 1 + Field 2A      total points 200

OR

Advanced = Field 1 + Field 2B + Field 2C      total points 200

Numbers for each drone – 2 team numbers

**Field 1** element: 1 starting location – required control.

**Field 2 A** element: one (1) gate. The gate will have an opening of at least 24” either 24” length and 24” height or 24” diameter. Height from the floor will be from 12 to 48” Launch location, landing location may be different.

**Field 2 B** Launch location, fly over a wall and land on a target. Target is behind the wall unseen by pilot. Second team member maybe be on target side directing pilot for landing

**Field 2 C** Launch location, fly over a wall (do not land) record objects on unseen side of wall. Choose either to use 3D goggles and record objects, relay camera objects to cell phone, or computer, or record objects with drone camera for downloading on return to launch location. Prepare a presentation from drone photo and give to judges for scoring. (Note: team must bring computer for downloading pictures of objects)

**Pit Area:** General workspace for each team designated as a “pit” area

A pit area where teams work with drones will be provided. Each team will have a conference table, two chairs and access to a 120-volt electrical outlet. A practice area will be provided with one gate.

## Supplied by the Competing Team:

**Each team MUST have control of drone at all times**

Safety equipment – **Eye Protection is required at all times!!!**

Laptop computer (optional) used in **Field 2 C**

Drone – with extra blades, batteries charged (we recommend 10)

Blade guards on drone when flying

(one charged battery for each flight -5 flights required)

(know charge time for each battery and flight time for each battery)

Drone controller with batteries

Power strip

Battery charger

Tools required for working on drone

You will need to modify this drone to carry a payload. (see directions for payload challenge 1)

Drones that you might consider are:

JJRC H31 pictured

SYMA X5SW pictured

QuadTone Tumbler 2.0 pictured

Many larger drones have been reduced in price.



Husband X4 H107L RC Quad Copter, 4 Channel, 2.4 GHz



Feel free to choose a different drone, keeping in mind the gate opening will be 24 inches (609 mm) wide and 24 inches (609 mm) high.

At this time the use of FPV may be used. This contest will be modified to include computer programming as the technology advances.

Please note any challenges this contest presents, so changes can be made for next year. Thank you for your help.



### **Basic Challenge Overview**

A two-member team brings a prebuilt drone to the competition. During the competition, the team will remotely operate the drone which should be capable of launching and flying two fields as directed by judges. One field will demonstrate team's control of the drone.

**Field 2 A** will ask the team to preload a payload, fly through a gate with a payload, land on a mark, unload the payload, and reload a

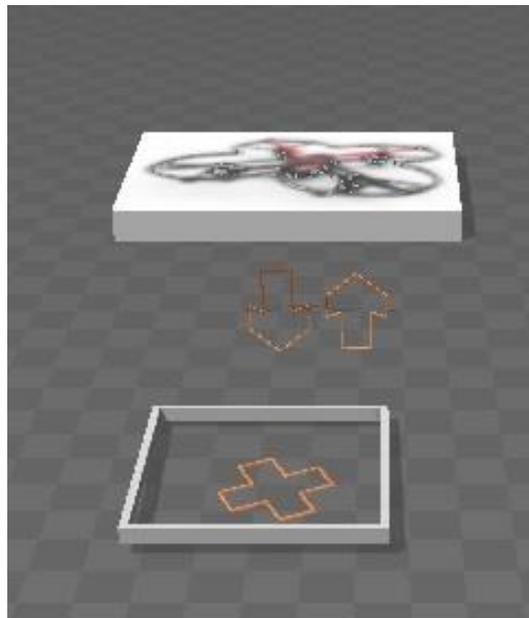
second payload flying back through the gate for delivery at starting mark **Each team must complete field (1) before going on to field (2)**

### **Basic Field 1**

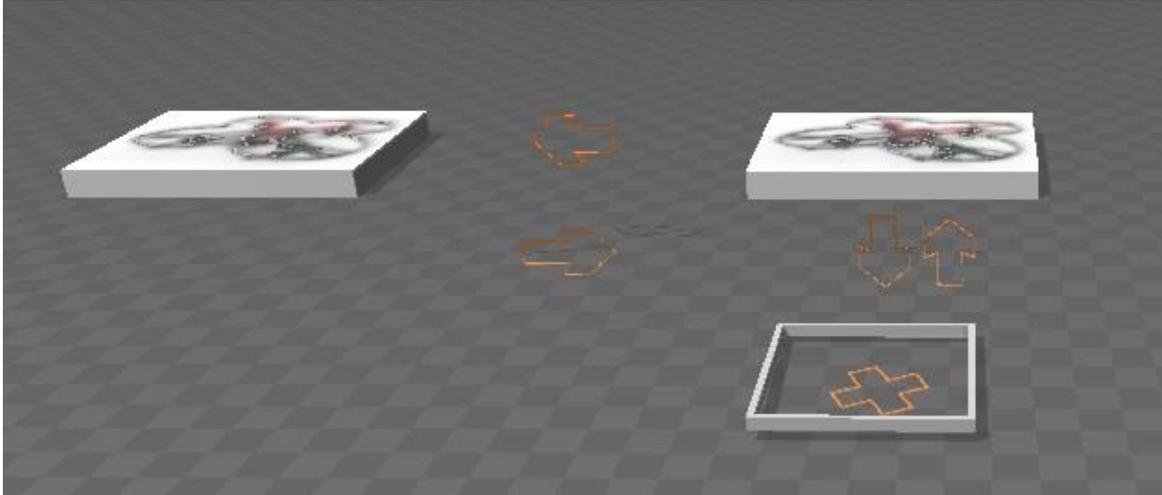
**Areas of judging will cover: Field 1** will be an open area for flight.

**Team may change batteries between each field.**

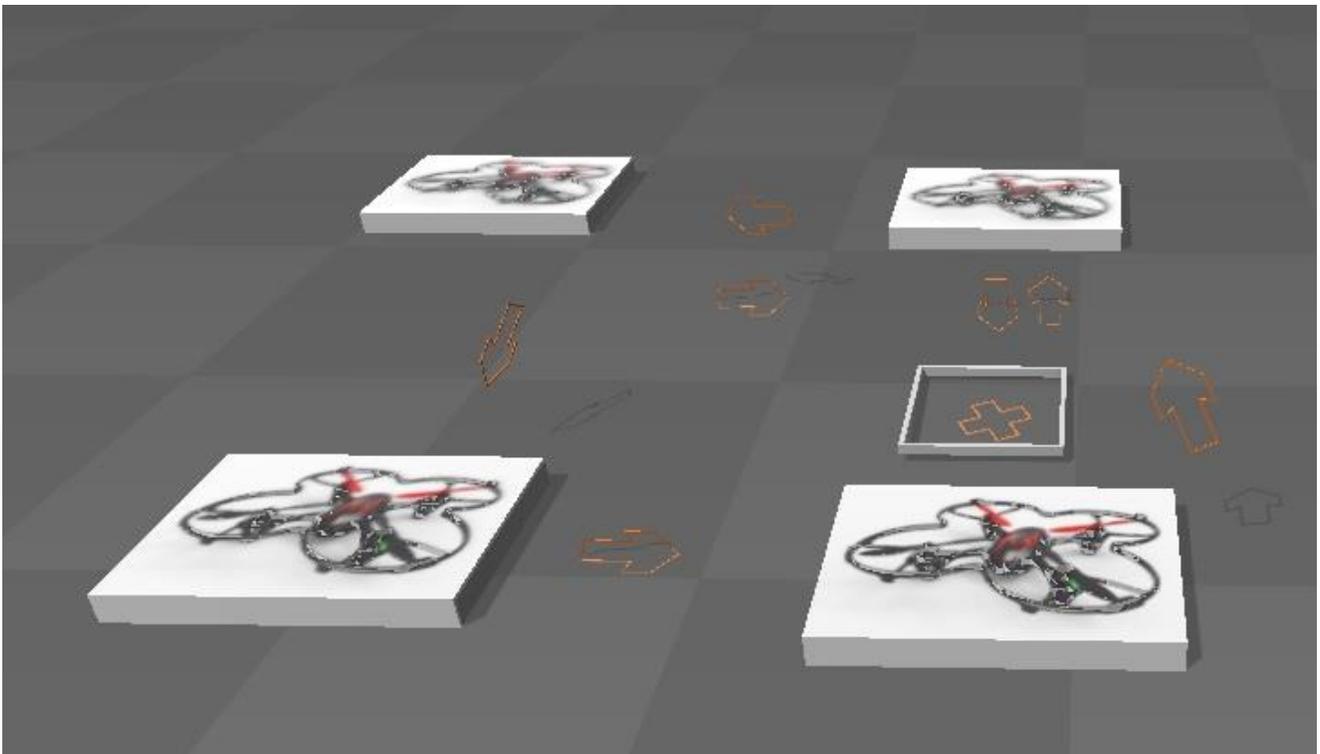
Launch from a starting position to a hover between 3 to 5 feet above start position for 5 seconds then land at starting position.



2. Launch from starting position to hover position then move in a straight line forward 5 feet-stop-back 5 feet to hover position and land at start position.



3. Square: Launch from start position to hover position – fly forward 5 feet-hover then turn 90 degrees (either right or left) fly 5 feet forward and hover turn 90 degrees and fly forward 5 feet hover turn 90 degrees and fly forward 5 feet hover over starting position for landing then land.



4. Circle: Launch from start position to hover position –turn 90 degrees fly in a circle of at least 3-foot diameter ending circle over starting position for landing then land.

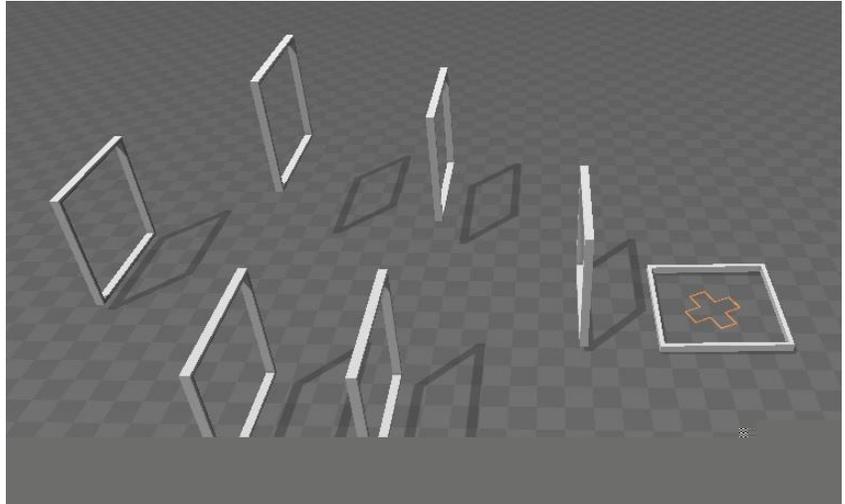
5. Figure Eight: Launch from start position to hover position- (this is the center of the figure eight) start you figure eight from this position making one loop ending over the center and continue second loop to complete figure eight. Fly back to hover over starting launch position and land.

**Five scores** (one for each challenge) will be added together to render one score for this field.

## Challenge Field 2 A

**Areas of judging will cover:** Field 2 A will have one gate position (you chose position) There will be a start and landing mark on other side.

Launch from a starting position. Fly with preloaded payload.( See Fig.1 payload) and fly through gate one. Land payload on the mark, other side of gate. Unload payload and reload the second payload. Fly back through the gate and land on starting mark.



Your time in completing the gate will be recorded.

### Fig 1 Payload

If you build one for yourself you will need to shape a wire handle.

4" high by 3" wide 5" high with handle up- Box = 1 oz.

Each team will be given one box for practice.

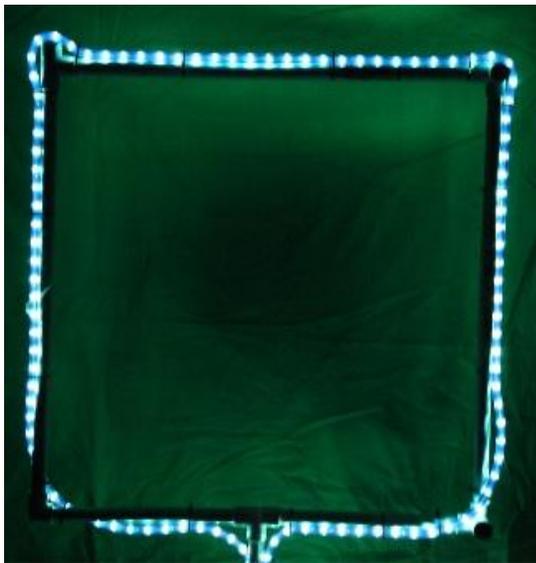
You may put any weight you want in the box (as long as your drone will carry the weight).

JA Kitchens Chinese Take Out Food Boxes With Wire Handle, 16 oz, Pack of 50

[https://www.amazon.com/s/ref=nb\\_sb\\_noss?url=search-alias%3Daps&field-keywords=+chines+carry+out+food+cartons](https://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Daps&field-keywords=+chines+carry+out+food+cartons)



4" high by 3" wide 5" high with handle up-  
Box = 1 oz.



Gate

Time will begin when you launch from the start position:

**Once you start a flight you may NOT touch your drone nor change batteries.** If you crash or the drone can no longer fly the run time will be recorded for that flight.

**Please note: After first flight to other side, the second team member may change batteries for flight back through with second payload. After second flight back to start, the battery maybe changed for third flight and again for the fourth flight.**

One team member (flying the drone) will stand and preload the drone from the starting mark. You will place the drone on the starting position as directed by the judge. You will preload your drone with payload one (1). Payload will be marked and in color

Second team member will be on the other side of the gate, ready to unload and reload payload from second mark. **Drone must be turned off for safety unloading and reloading. (change battery if needed)**

From the second mark (with second payload) restart drone and fly back through the gate to starting mark for unloading. **Drone must be turned off for safety unloading and reloading. (change battery if needed)**

If your drone flies outside of the field parameters, that flight will not count and you may be disqualified by the judges. Each team must keep their drone in line of sight and have control of the drone at all times.

Your drone may not enter the challenge field while another team is flying.

You must be able to load and unload the box as shown. You choose how to carry the payload (box).

It might look like this:

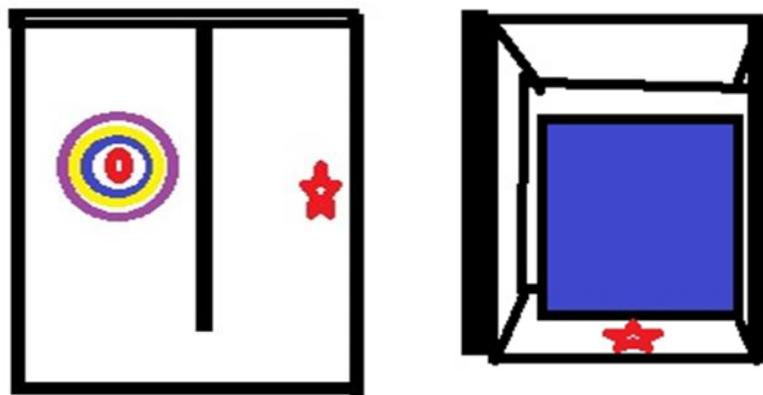


## Challenge 2 B

The 2 B field will ask the team to fly using FPV. From a starting mark, one team member will drive the drone over a wall (non-see through) and land on a target on the other side. The target will be marked with rings in colors with each color ring values being marked. Each ring worth 10 points each. **Center mark is worth 50 points**

The judge will decide which ring and value will count.

Once you start a flight you may NOT touch your drone nor change batteries. If you crash or the drone can no longer fly the run time will be recorded for that flight.



Top view Front View

The judge will move the target out of view of the drone pilot. The judge and the second team member will stand of the target side so

the team member can direct the drone pilot when drone has landed and needs to be turned off.

Team will make sure the FPV is working at all times and the non-pilot can direct the pilot for safety.

After landing on the target, the pilot will turn off the drone for scoring with the judge. Only after the judge informs the team all is clear; the team can clear their drone from the field.

### **Challenge 2 C**

The 2 C field will ask the team to fly using FPV. From a starting mark, one team member will drive the drone over a wall (non-see through)

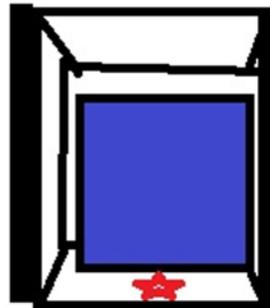
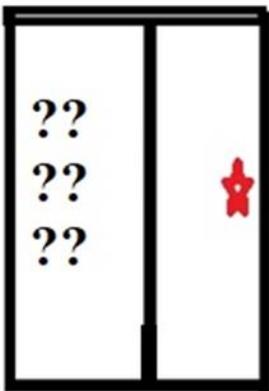
The team will decide how they are to view the objects on the unseen side. The team may choose to only use 3D goggles relaying to the second team member what is being seen on the other side. Or the drone may send pictures back to the team's cell phone for recording objects on the unseen side. Or the drone may take still pictures of objects for downloading to the team's computer for viewing and recording objects on the unseen side. (note team must bring a computer for downloading drone pictures.) Total points will be 100 points. Objects will include farm animals, buildings, crops, and wild animals. Information needed to complete report includes number

of animals, color of animals, type of animals, and location of animals, other objects such as fences, machinery and people.

Prepare a drone photo presentation for judges to score.

Use computer for photo presentation.

Once you start a flight you may NOT touch your drone nor change batteries. If you crash or land, the challenge is over and object recording will stop.



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### Engineering Notebook

The Engineering Notebook will be submitted for judging at check-in.

Required elements:

Overall neat and professional appearance

Complete list of materials for the drone with cost.

Description of drone and materials with supporting materials

Illustrations, sketches, photos, and written log entries accurately documenting the design and skill development with evolution of skills.

Rules for drones with the FAA registering information and fees. How long is the registration valid for? Where does the registration number go on the drone and how you would label your UAS?

### **Written Test**

The test will be given as a team test. Both members of the team are to work together only. No outside help or communication of any kind.

The test will cover Terminology, mechanisms rules, guidelines and laws- local and national from FAA.

### **Final Scoring:**

Written test, Engineering Notebook, Field One and Field A