



Drone Technology Team Guide

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

Event

The **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.







Union Pacific has a team of drone operators, computer and software engineers who have been working non-stop for the last four months to make autonomous drones a reality.

Union Pacific hopes to have close to 250 employees certified to fly drones by December 2018.

"We are at the leading edge of this industry, and in some ways hanging over the edge," Meder said. "I can't wait to see what's next."









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.

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

Supplied by Technical Committee:

Challenge field

Numbers for each drone – team numbers

Field 1 element: 1 starting location

Field 1 elements: 6 gates. Each gate will have an opening of at least 24" either 24"length and 24"heigh or 24" diameter. Height from the floor will be from 12 to 48" Launch location, landing location may be different.

A command center area equipped with a table and 2 chairs.

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)

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

At this time, the drone that was used last year for this contest **may NOT be used** for this year's Drone Basic Challenge Field Two. If the <u>Hubsan X4 H107L CANNOT carry the payload</u>, another larger drone should be chosen.

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

Quadrone Tumbler 2.0 pictured

Many larger drones have been reduced in price.







Hubsan 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.

The second field will ask the team to preload a payload, fly through gates with a payload, land on a mark, unload the payload, and reload a second payload flying back through the gates for delivery at starting mark. Repeat this a second time. Course will be 6 or more gates, 24" length and height. There will be four (4) payloads to be delivered. This means each team will fly four (4) times through the course carrying four (4) different payloads.

Each team must complete field (1) before going on to field (2)

Basic and Advanced Field One

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

Team may change batteries between each field.

Launch from a starting position to a hover between 3 to5 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-stopback 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.

Basic Challenge Field Two

Areas of judging will cover: Field two will have 6 gates (or more) positioned throughout: 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 and each gate in the numbered order given by the judges, carrying the payload through all gates. Gate number sequence may be changed by the judges. Land payload on the mark, other side of gates. Unload payload and reload the second payload. Fly back through gates and land on starting mark, for unloading of second payload. Reload third payload for flight back through course for delivery of third payload (land on mark). Unload third payload and reload with fourth payload for delivery back through course and starting mark for landing. Teams will be given the gate sequence before your challenge. Your time in completing the gate sequence 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&fieldkeywords=+chines+carry+out+food+cartons



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

Chinese Take Out Box

Instructions

- Photocopy pattern onto cardstock.
 Cut on all solid lines, and score all dotted lines.
- 3. Stamp on the clean side.
- 4. Fold into a box shape, and glue the side tabs.





Gates

Time will begin when you launch from the start position:



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

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

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 course (gates), 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 course to starting mark for unloading and reload third payload. Drone must be turned off for safety unloading and reloading. (change battery if needed)

Fly through the course carrying payload three to second mark for the second team member. Drone must be turned off for safety unloading and reloading. (change battery if needed)

Second team member will unload third and reload fourth payload for flight back through course to starting mark.

When drone lands and is unloaded, **Drone must be turned off for safety unloading and reloading.** Time will be recorded.

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:





Advanced 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. Teams will demonstrate control of the drone using FPV on the same field as the Basic Challenge Field One. You will be required to perform the same tasks as Basic Challenge Field One before going on to Advanced Challenge Field Two.

The second 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 20 points each. Center mark is worth 100 points. Two scores will be taken. One score is the time from takeoff to landing. Second score is the point value of the ring the drone lands on.

The judge will decide which ring and value will count.

Advance Challenge Field Two

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.





Field two 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 form the field.

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 Two