

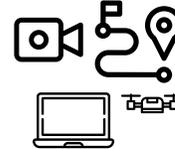
Overview

New for 2021 only! **Droneworks** will be completely virtual. Participants research the use of drones related to the given theme and create a **digital poster**. Participants also demonstrate their knowledge of drones and coding by completing an **autonomous flight challenge**. Teams will complete the autonomous flight challenge off-site and upload a video submission. More details and answers to frequently asked questions are available at the Droneworks website (www.drone-works.org).

Event Components



Digital Research Poster



Autonomous Flight Challenge Video

Pre-submit Poster & Video by
March 24, 2021



Team of 1-2 Students
2 Teams per Chapter

- One (1) Pilot
- One (1) Spotter

In a Team of one (1) participant, the individual may serve as both Pilot and Spotter.

Pilot and Spotter may switch roles during competition.

Research Theme

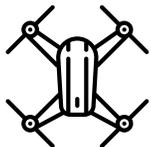
Drones & Sports

From practicing in the backyard to the Olympics, people in Oklahoma love sports. Identify up to three (1-3) ways a drone may be used to enhance the sports experience.



Safety Glasses

Safety glasses required for ALL participants



Programmable Drone



Smartphone, tablet, or computer to code drone

- Drone must be programmable and capable of autonomous flight.
- With all components attached, drone must not exceed the following dimensions:
 - 8 in (20 cm) width
 - 8 in (20 cm) length
 - 5 in (13 cm) height (as measured from the surface the drone is resting upon to the highest point of the drone, with all its components attached)
- Drone weight (with all components attached) must not exceed 3.5 oz (100 g).
- Propeller guards/cage may be used if, once attached, the overall drone size does not exceed the dimensions listed above.
- A computer/tablet/smartphone is required to program autonomous flight using MIT Scratch, Python, or applicable apps.

A list of suggested drones is posted on the Droneworks website (www.drone-works.org)

Documentation (Online Submission)

40 points

Given the theme listed above, create a **digital research poster** illustrating and explaining **up to three (3) ways drones may be used** related to the theme. Submit your digital poster by **March 24, 2021**.



Digital Research Poster (PDF)

- Digital Poster must be submitted as a **2-page PDF**.
- Poster may be **no larger than 22 in. x 28 in.**
- Color or gray scale is acceptable.
- Any medium may be used. (e.g., digital, photographs, pencil, paint, marker)
- Physical poster may be created, photographed, and submitted as a PDF file.
- Any photographs or digital media used must be properly credited in Research Bibliography.

First page must contain:

- Theme
- Research description in **300 words or less**
- Research description may be typed or handwritten
- Digital or hand-drawn **illustrations/photos (2-3)**

Second page must contain:

- Team/chapter ID number
- Research Bibliography** citing sources of research information and illustrations/photos



Ratings Criteria

- Theme Research
- Illustrations
- Layout and Design
- Research Bibliography

Digital Research Poster must be submitted by
March 24, 2021

 **Definitions**

Airspace – The “Airspace” is the drone’s competition environment. It is an area 10 ft. long x 10 ft. wide. The Helipad and Target Zones are all part of the Airspace.

Autonomous Flight – A flight in which the Drone operates and reacts only to sensor/camera inputs and to commands pre-programmed by the Team onto the Drone Control System. Human control of the Drone is not permitted during this time.

Drone Control System – The “Drone Control System” is the hardware and software used to control a Drone. It includes the smartphone, tablet, or computer used to program/code the Drone. Only the Pilot may operate the Drone Control System.

Emergency Landing – For safety reasons, we ask that you include code to Land or Power Down the Drone immediately.

Handle/Handling – A Spotter is allowed to hand-rescue or “Handle” the Drone and/or detached parts during the Autonomous Flight as long as the drone is Powered Down. The Spotter may return the Drone to the Helipad to continue competition.

Helipad – The “Helipad” is the 2 ft. x 2 ft. square marked with the letter “H.” It is where the Drone is to be placed before Takeoff.

Land/Landed – The condition where the Drone is not in flight and is motionless for at least two (2) seconds. An “emergency stop” or forced landing may not be used to score.

Manual Flight – A flight in which the Pilot operates the Drone using human control.

Pilot – The “Pilot” is the participant responsible for operating and controlling the Drone. The Pilot must always remain in the Pilot Area unless the Team has only one (1) member acting as both Pilot and Spotter.

Pilot Area – The designated area adjacent to the Airspace from where the Pilot executes the autonomous flight code. Only the Pilot may be in the Pilot Area.

Powered Down – The condition where the Drone is not in flight, there is no power to the Drone, and the propellers are not spinning.

Spotter – The “Spotter” is the participant responsible for placing the Drone on the Helipad before Takeoff. The Spotter remains outside the Airspace unless the Drone is Powered Down. When the Drone is Powered Down, the Spotter may enter the Airspace to Handle a Drone that has crashed.

Takeoff – The Spotter places the Drone on the Helipad. Power may not be applied to the Drone until the timer begins. Once the Spotter is completely outside the Airspace, start the countdown (“3, 2, 1, Go”) and the timer begins. At that time, the Pilot may apply power start the Autonomous Flight program.

Target Zone – A Target Zone is a square marked within the Airspace where the drone must land to score points. Target Zones come in three (3) sizes: 2 ft. x 2 ft., 1 ft. x 1 ft., and 6 in. x 6 in. Point values vary based on Target Zone size. Over half of a drone must be within a Target Zone to score points.

Team – A “Team” consists of one to two (1-2) participants with one (1) serving as Pilot and one (1) serving as Spotter. In a Team of one (1) participant, the individual may serve as both Pilot and Spotter.



Autonomous Flight Video (Online Submission)

60 points

Demonstrate the drone's **autonomous flight** capability. Using Scratch, Python, or applicable apps, participants will code their drone to navigate the challenge autonomously and score as many points as possible within **one (1:00) minute**. Submit a **video** of the drone completing the autonomous flight challenge by **March 24, 2021**.



1-Min. Round

Code and video your drone completing the Autonomous Flight Challenge within one (1) minute.



Autonomous Flight Challenge

As with sports, accuracy and precision are important for drone operation. The Autonomous Flight Challenge is to score the most points by coding your drone to **land on each of the target zones** accurately and precisely within **one (1:00) minute**.

You may only land on each target zone one (1) time.
Over half of a drone must be within a target zone to score points.

Autonomous Flight Rules

- A. The challenge must be completed within **one (1:00) minute**.
- B. The autonomous flight challenge and point values are listed on the next page.
- C. The autonomous program specifications are as follows:
 1. The drone must takeoff from the helipad (H).
 2. Each target zone may only be landed on one (1) time.
 3. Target zones do not need to be navigated in any specific order.
 4. Navigating the target zones can be done collectively with a single autonomous program or individually with multiple programs, or any combination in-between.
 5. An "emergency stop" or forced landing may not be used to score points.
 6. No changes may be made to the autonomous program code while flying.

Autonomous Flight Challenge Construction

- A. Using the given dimensions and locations, use masking or painters' tape to mark off the perimeter of the airspace. Helipad and target zones may be marked with tape, paper squares, cardboard squares, etc.
- B. The pilot area need not be marked if the pilot does not stray from the designated area south of the helipad.



TIP

Choose a location with good lighting, no shadows, and no glare on the floor. The drones use optical sensors to determine their position and need adequate light and contrast to fly accurately.

Autonomous Flight Video

- A. Use a camcorder, camera, or cell phone to record the video. Use a third person or a tripod. Do not try to film and fly.
- B. Choose a location with plenty of light.
- C. Upload a **single, unedited video** showing your autonomous code, your autonomous flight, and your scoring recap with no pauses. Keep your camera rolling.
- D. Before your autonomous flight:
 1. **Video a brief review of your autonomous code.** You can print it out or show it onscreen from your drone control system (smartphone/tablet/computer). If you have multiple programs, please show them all.
 2. Choose a location for your camera. Position your camera to record the entire challenge area, preferably angled downward so the helipad and all target zones are visible.
- E. During your autonomous flight:
 1. Set an **audible timer to one (1:00) minute**.
 2. Power up the drone and connect to your drone control system (smartphone/tablet/computer)
 3. Place the drone anywhere within the helipad (H).
 4. Only one (1) team member will be allowed in the pilot area. This team member will serve as the pilot and will start the autonomous program(s).
 - a. No autonomous programs may be started until all persons are out of the airspace.
 5. A second team member will serve as the spotter.
 - a. The spotter must remain outside the airspace while power is applied to the drone propellers.
 - b. If using multiple flights, the spotter may enter the airspace, pick up the drone, and move it back to the helipad for an additional flight.
 6. If the team consists of one (1) participant, the participant may act as both the pilot and the spotter.
 7. Provide a **verbal** countdown ("3, 2, 1, Go")
 - a. The pilot may start the autonomous program.
 - b. Start the one (1:00) minute timer.
 8. Provide **verbal** commentary ("We landed on the 2 ft. target.") during the autonomous flight challenge.
 9. At the end of the one (1:00) timer, everything stops.
 - a. If the drone is moving, it must be landed, and the propellers powered down.
 - b. Target zones completed after the end of the timer will not be scored.
 10. When the autonomous programs are completed or the one (1:00) minute timer has expired, provide a **verbal** statement of "We're finished" or "Time is up."
- F. After your autonomous flight, provide a **verbal** recap of which target zones were scored.



Video Submission should include:

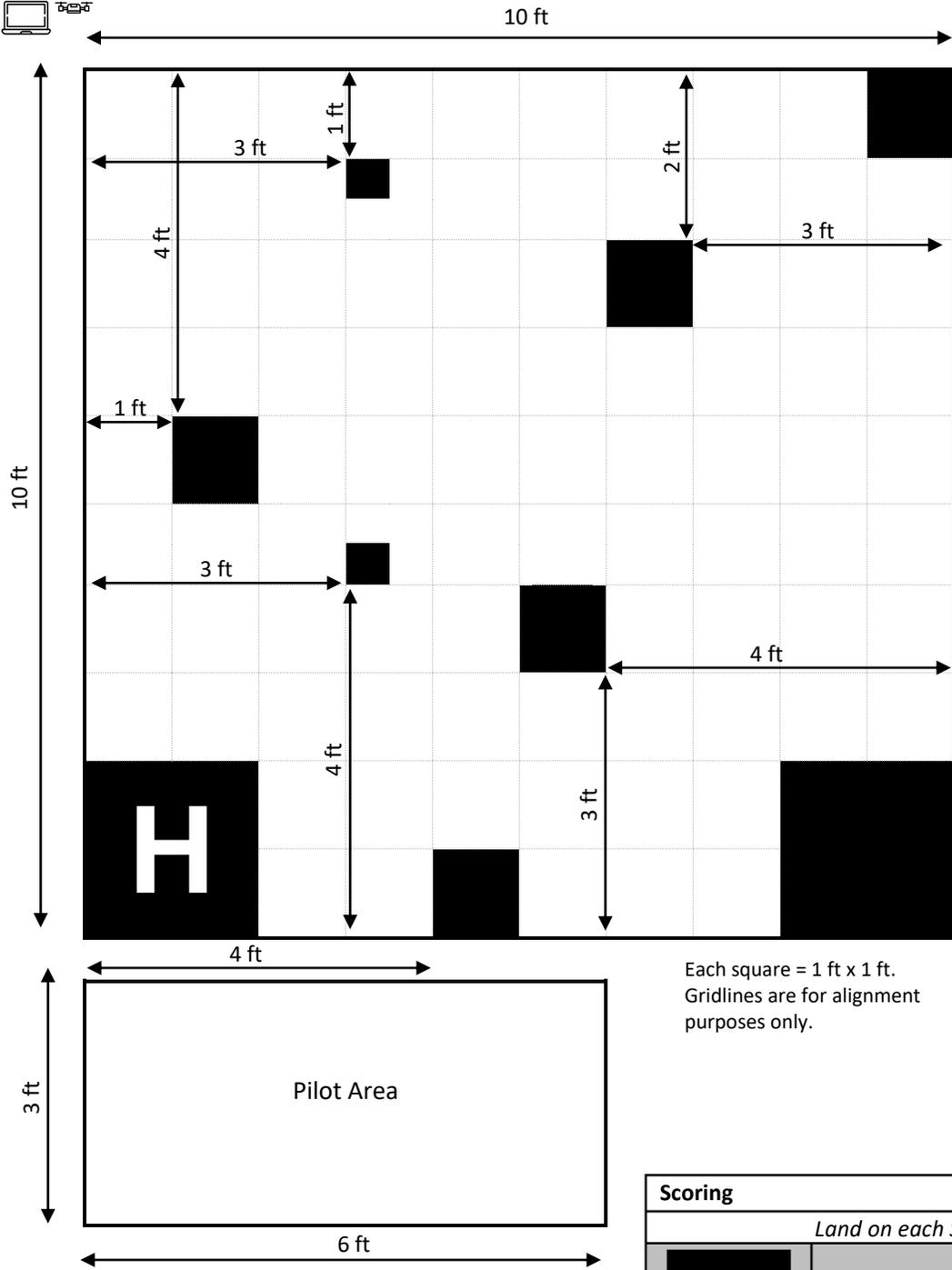
1. Brief review of autonomous code
2. Autonomous flight
3. Scoring recap

Autonomous Flight Challenge Video must be submitted by

March 24, 2021.



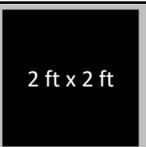
Autonomous Flight Challenge



Each square = 1 ft x 1 ft.
Gridlines are for alignment purposes only.

- Land on each target zone within 1:00 minute
- Score as many points as possible within 1:00 minute
- Drone may only land on each target zone one (1) time
- Target zones do not need to be scored in any order
- Over half of a drone must be within a target zone to score points
- Landing on all eight (8) target zones may not be possible within 1:00 minute
- Drone must begin flight within the helipad (H)
- If using multiple programs, spotter may pick drone up at end of program and return drone to Helipad (H) for additional flight
- Targets scored after the 1:00 timer expires do not count

More details and answers to frequently asked questions are available at the Droneworks website (www.drone-works.org).

Scoring			
<i>Land on each Square Target Zone</i>			
	2 ft. x 2 ft. Square	Yes / No	4 pts.
	1 ft. x 1 ft. Square	1 2 3 4 5	6 pts. each
	6 in. x 6 in. Square	1 2	13 pts. each
Total Score (60 pts.)			

Participant/Team ID# _____

Judge _____

DRONEWORKS:MS

2021 OFFICIAL RATING FORM

MIDDLE SCHOOL (OK ONLY)

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

Go/No Go Specifications

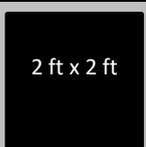
- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

- Digital research poster was submitted.
- Autonomous flight challenge video was submitted.
- ENTRY NOT EVALUATED

DOCUMENTATION (40 points)				Record scores in the column
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
Theme Research (X1)	There is little or no evidence of understanding drone capabilities.	There is some evidence of research and understanding of drone capabilities and use.	There is solid evidence of in-depth research and understanding of drone capabilities and use.	
Illustrations/Photos (X1)	Poster does not have correct number of illustrations/photos (2-3) or is missing theme.	Use of most illustrations/photos reflects good technical skill; illustrations add to the research and theme.	Use of illustrations/photos is excellent, illustrations enhance research and theme. They are of high esthetic quality.	
Layout and Design (X1)	The design is sloppy, there is poor choice of layout; the poster is not professional, and/or it leaves an unfavorable impression.	The design has good points, but some details may distract from the overall quality.	Poster is aesthetically pleasing, and all design principles are well incorporated into the design and layout.	
Research Bibliography (X1)	The research is inadequate, and/or very few credible sources are referenced.	The research is adequate, and it includes a few credible sources.	The research is comprehensive, and credible resources are included.	
DOCUMENTATION SUBTOTAL (40 points)				
AUTONOMOUS FLIGHT (60 points)				
Autonomous Flight Challenge Total Score from below. (Challenge point values listed in the Droneworks Event Guide.)				
AUTONOMOUS FLIGHT SUBTOTAL (60 points)				
(To arrive at the TOTAL score, add the DOCUMENTATION SUBTOTAL and the AUTONOMOUS SUBTOTAL.)			TOTAL (100 points)	

AUTONOMOUS FLIGHT CHALLENGE SCORESHEET

Please circle one selection for each item.

Land on each Target Zone			
	2 ft. x 2 ft. Square	Yes / No	4 pts.
	1 ft. x 1 ft. Square	1 2 3 4 5	6 pts. each
	6 in. x 6 in. Square	1 2	13 pts. each
Total Score (60 pts.)			