SkillsUSA
NEBRASKA

Drone Technology-ADVANCED

Virtual Team Guide

April 2024

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

The **2024 Drone Technology Event** is poised to equip students for diverse opportunities across industries leveraging this burgeoning technological domain. Drones offer a compelling proposition, being both cost-effective and delivering heightened safety, speed, and precision compared to conventional aerial data acquisition methods. Moreover, their integration into national airspace presents a transformative platform for industries, enabling the optimization of autonomous drone operations and the redefinition of business models.

In agriculture, specialized imaging sensors coupled with drones facilitate optimized autonomous mapping flights over farmland, yielding valuable insights into plant health and other metrics. In construction and surveying, drones are increasingly indispensable, capable of scanning job sites and generating highly detailed 3D maps with centimeter-grade accuracy. These maps empower construction professionals with timely data for asset tracking, surveying, 3D modeling, and site planning, among other applications.

Similarly, the energy sector benefits from drone technology for risk management, ranging from pipeline monitoring to assessing vegetation encroachment on transmission lines. Drones enable the swift and cost-effective gathering of aerial imagery, aiding in the early identification of potential crises such as spills and outages.

Furthermore, drones are revolutionizing the mining industry by enabling operators and end-users to monitor stockpiles, identify exploration targets, and track equipment with unprecedented efficiency and safety. Photogrammetry, facilitated by GPS-enabled drones, is increasingly standard practice for mapping the Earth's surface, underscoring the advancing role of consumer drone technology in this domain.

Moreover, drones are playing a pivotal role in environmental conservation efforts. From monitoring wildlife populations to assessing habitat changes, drones offer a non-intrusive and efficient means of gathering critical ecological data. Conservation organizations and researchers leverage drone technology to conduct aerial surveys, map ecosystems, and monitor the impacts of climate change on fragile environments. This capability not only enhances our understanding of ecological dynamics but also informs conservation strategies and policy decisions aimed at safeguarding biodiversity.

In addition to their applications in traditional industries, drones are increasingly utilized in emergency response and disaster management scenarios. Equipped with thermal imaging cameras and other specialized sensors, drones can swiftly assess disaster-stricken areas, identify survivors, and map out access routes for rescue teams. Furthermore, drones aid in assessing structural damage to infrastructure, facilitating rapid response and recovery efforts. Their ability to provide real-time situational awareness in challenging environments makes drones indispensable tools for emergency responders and humanitarian organizations worldwide.

As drone technology continues to advance and become more accessible, its potential applications across various sectors are boundless. From enhancing agricultural productivity to revolutionizing environmental monitoring and disaster response, drones are reshaping industries and driving innovation at an unprecedented pace. As students engage with drone technology through events like the 2024 Drone Technology Event, they gain valuable insights into the limitless possibilities of this transformative technology, empowering them to become leaders and innovators in the future workforce.

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 a real-world situation.

Clothing Requirement:

Official SkillsUSA attire is required. For complete details, visit 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 the Competing Team:

- Safety equipment – **Eye Protection is required at all times!!!**
- Laptop computer or tablet (to present fields A3 and A4)
- Autonomous flight software for field A4 (trial version is acceptable)
- Drone with charged batteries (we recommend 3 batteries)
- Drone controller with charged batteries
- Blade guards on drone when flying
- Tools required for working on drone
- Battery charger (optional but recommended)

A pit area will be provided for teams to assemble and work on equipment. Each team will have a conference table, two chairs and access to a 120-volt electrical outlet. A practice area will also be provided.

At this time the use of FPV is not permitted.

Advanced Challenge Overview

A two-member team will remotely operate the drone, which should be capable of launching and flying three fields as directed by contest officials. Teams will be allowed to change batteries between fields.

Flight Test #A1: Each team must demonstrate positive control by completing a series of maneuvers, as directed by contest official. Time limited to 10 minutes.

Each team must complete Flight Test #A1 before proceeding to Flight Test #A2.

Flight Test #A2: Each team must launch from a designated mark and land on each of (4) landing zones, ultimately launching and landing on/from each landing zone. Time will be limited to 10 minutes.

Each team must complete Flight Test #A2 before proceeding to Flight Test #A3.

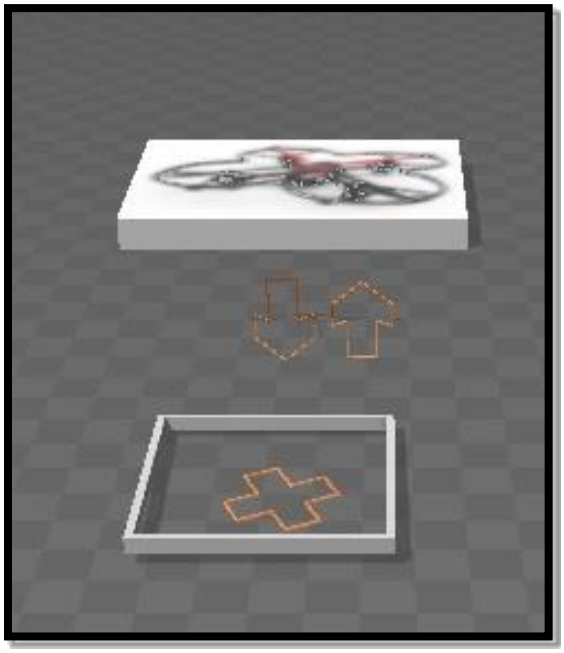
Flight Test #A3: Each team must launch from a designated mark and navigate through gates while capturing a photo of the image inside each of 4 containers. Time will be limited to 10 minutes.

Each team must complete the *flight* of Flight Test #A4 *prior* to the state competition.

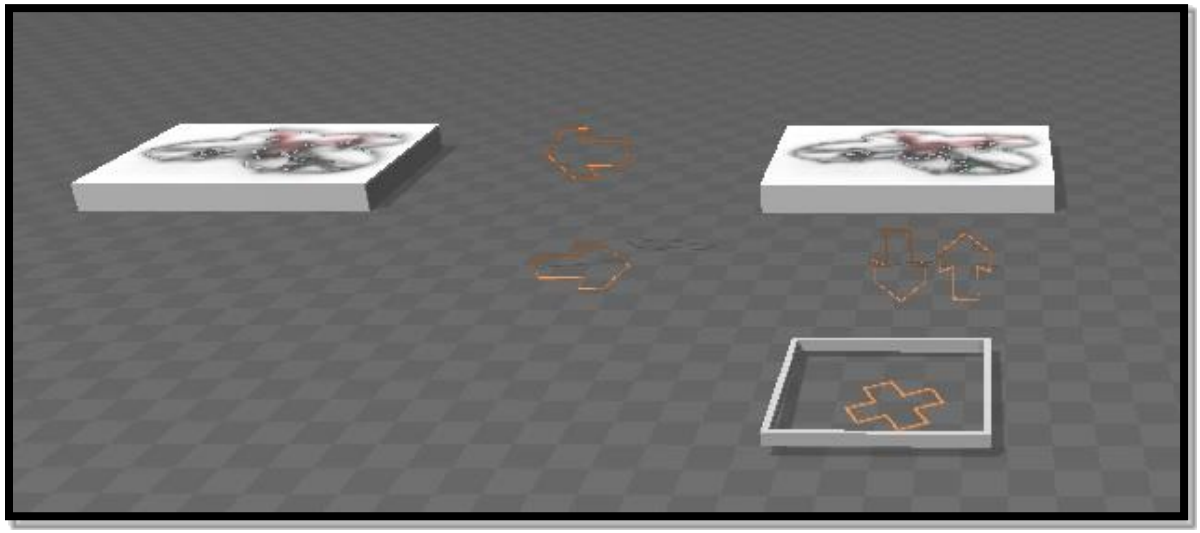
Flight Test #A4: Each team must fly an autonomous mapping flight of a site no less than 4 acres and present a report to the Competition Official.

Flight Test #A1

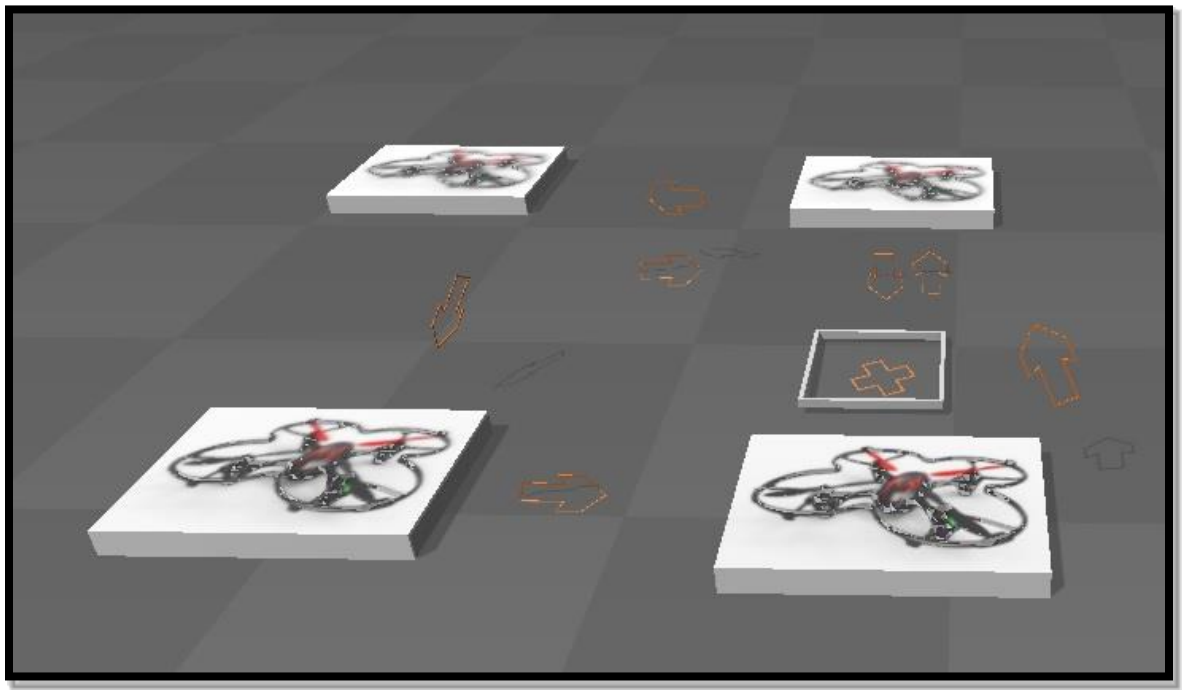
Launch from a starting position to a hover between 3 to5 feet above start position for 5 seconds then land at starting position.



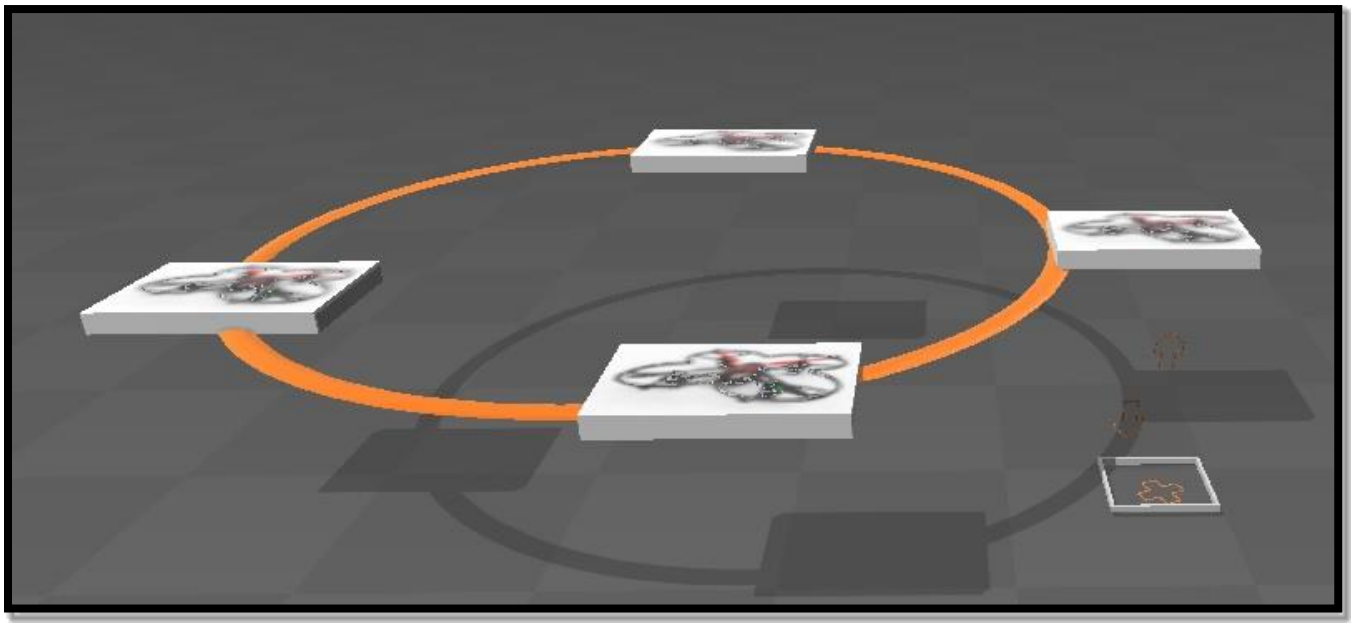
2. Launch from starting position to hover position then move in a straight line forward 5 feet-stop-back 5 feet to hover position and land at start position.



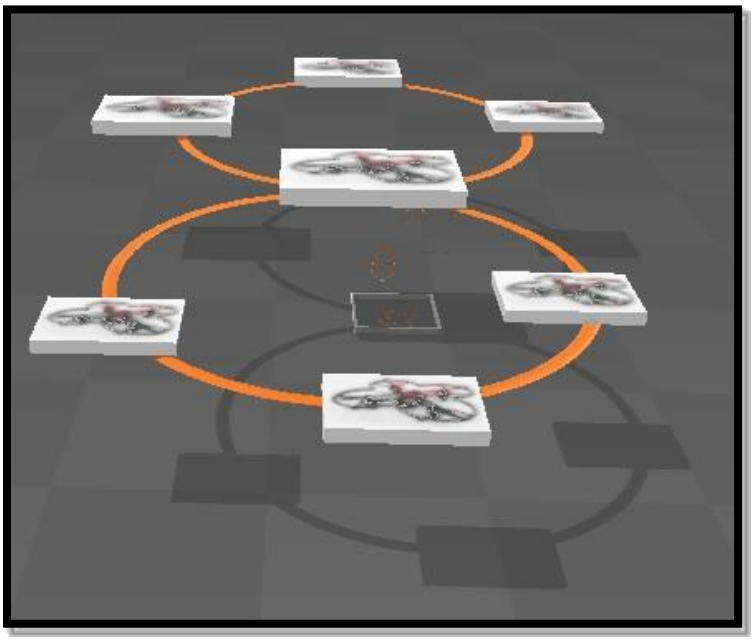
3. Square: Launch from start position to hover position – fly forward 5 feet-hover then turn 90 degrees (either right or left) fly 5 feet forward and hover turn 90 degrees and fly forward 5 feet hover turn 90 degrees and fly forward 5 feet hover over starting position for landing then land.



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.

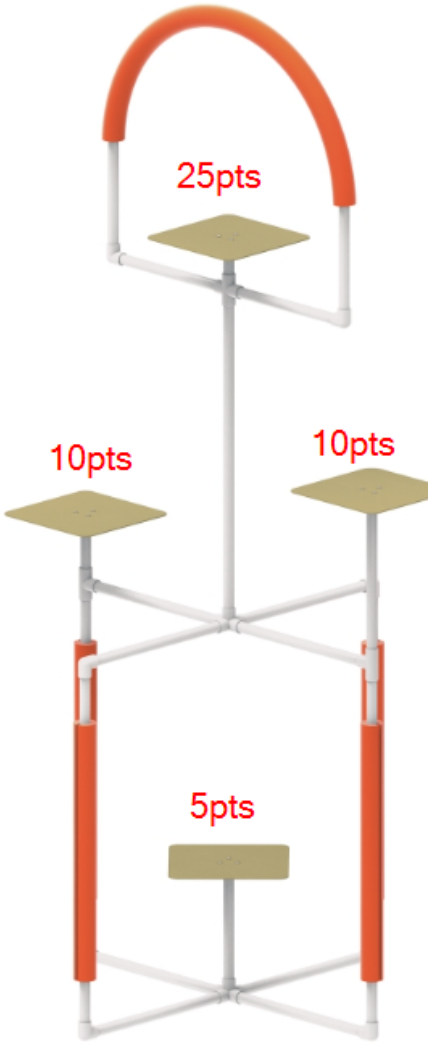


5. Figure Eight: Launch from start position to hover position- (this is the center of the figure eight) start you figure eight from this position making one loop ending over the center and continue second loop to complete figure eight. Fly back to hover over starting launch position and land.



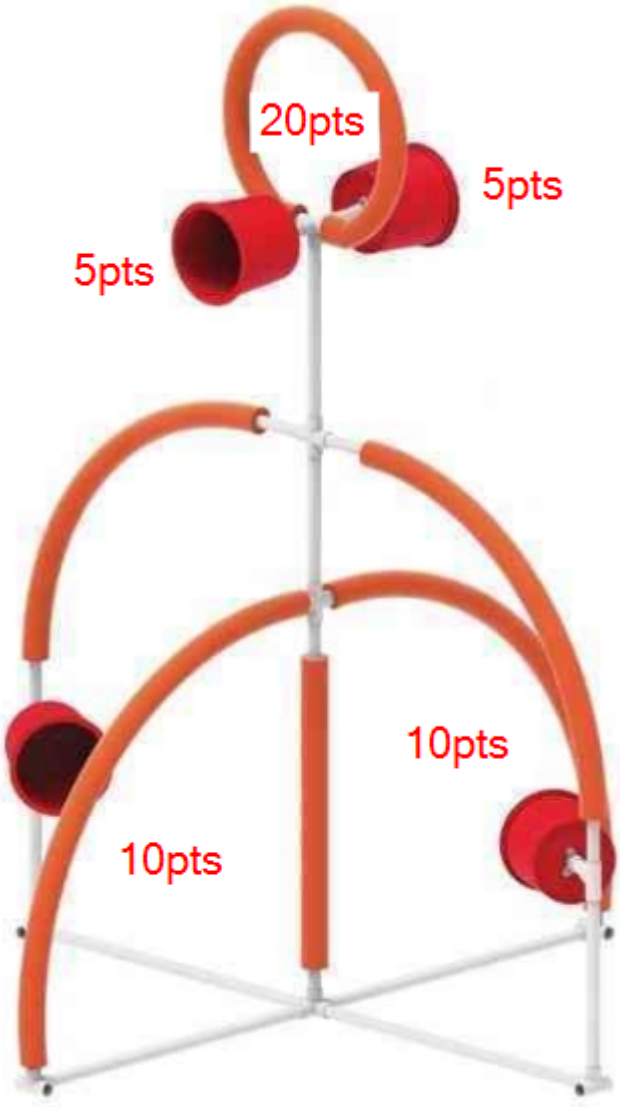
Flight Test #A2

Launch from a designated mark and land on one of the (4) landing zones. When directed by contest official, launch and land on a different landing zone. Continue until all (4) landing zones have been completed. Team must return to the primary/first launch mark to receive full point value. Time will be limited to 10 minutes.



Flight Test #A3

Launch from the designated mark and navigate through each gate while capturing a photo of the image inside the container. Continue until each gate has been successfully navigated and each container has been photographed. Each team must pass through the top gate then return to the primary/first launch mark to receive full point value. Once the flight is complete show the photographs to the contest official and describe what is in each image. Time will be limited to 10 minutes.



Flight Test #A4

This event will cover mapping and photogrammetry. You may use any mapping software you'd like, some examples include DroneDeploy, Pix4D, Litchi, Maps Made Easy, WebODM, etc. to complete an autonomous flight and present a report to the Competition Official.

The report should include:

- Description of the software used
    - Name of the software
    - Pros/Cons of software
    - Any problems you had using the software
- Overview of the flight plan
    - Screenshot of the actual flight plan
    - Altitude of the flight
    - How many photos were taken
    - Identify any obstacles on your site
    - Class of Airspace
    - Note any specific FAA rules or regulations that affected your flight
- Orthomosaic Map
- Elevation Heat Map or Site Contour plan with 1' and 5' Contours
- 3D Model of the site
- Volume of any stock piles on the site
- Number of trees, plants or rocks on the site

Example Field A4 Report

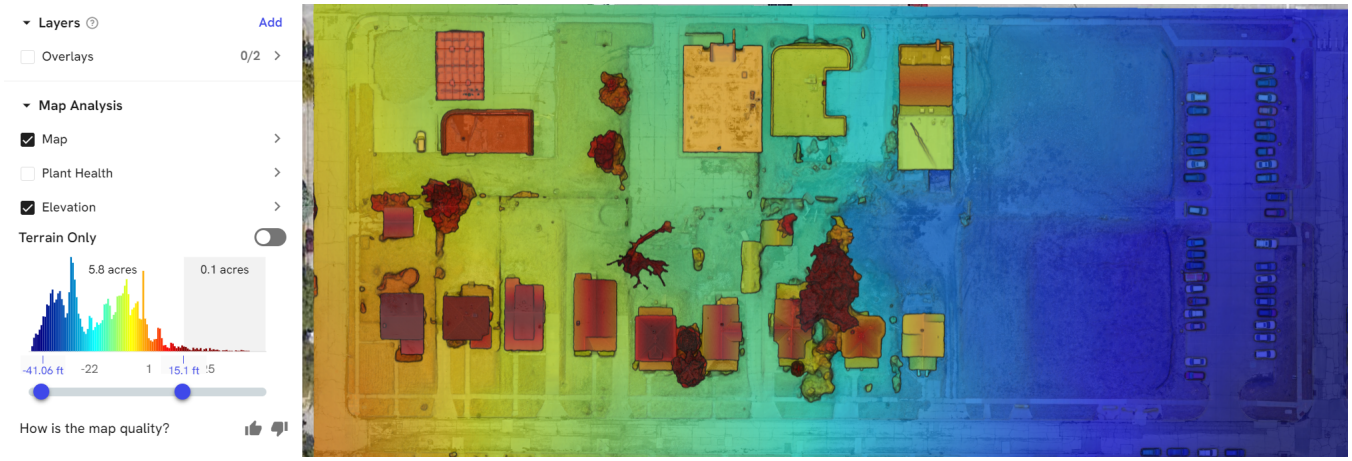
Team FlyGuy

Our team utilized a 30-day trial of the DroneDeploy platform to perform this autonomous flight. We chose this software due to the ease of use and compatibility with the hardware we use. We did not encounter any issues or problems using the software for the Field A4 flight.

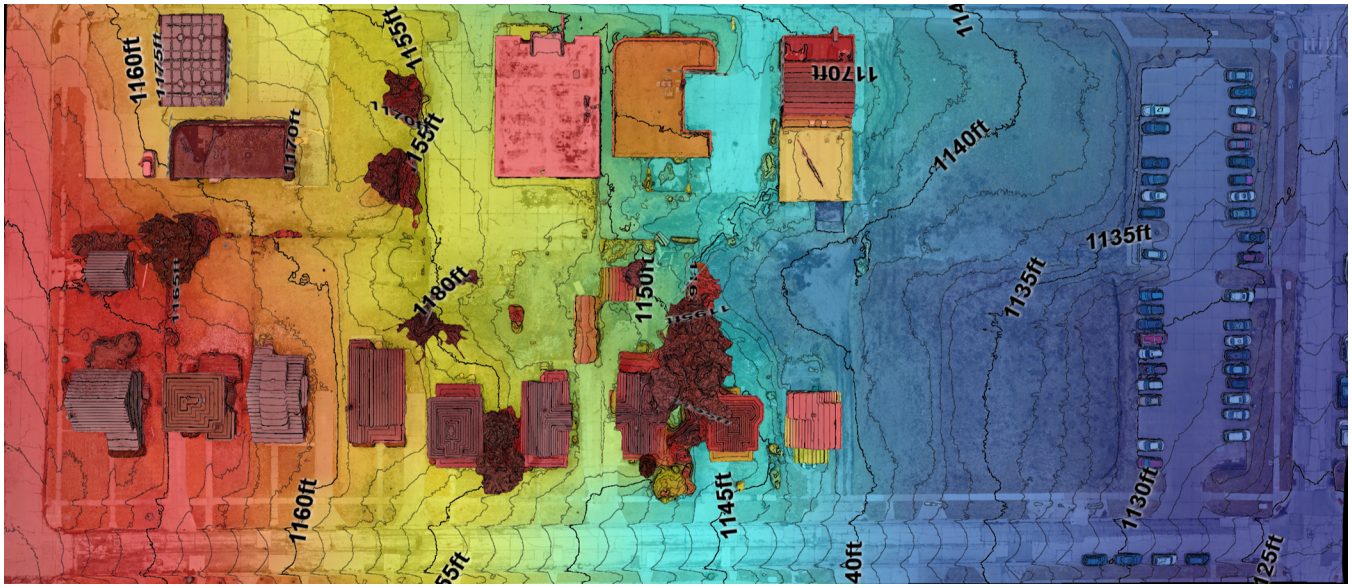
Flight Parameters:
Date: April 7, 2024
Weather: 65 degrees, sunny skies, SE winds at 7mph
Airspace: Class C
Maximum authorized altitude through LAANC: 400'AGL
Actual Flight Altitude: 200'AGL
Duration of flight: 10 minutes 42 seconds
Number of Photos: 190

Orthomosaic Map:

Elevation Heat Map:



Elevation Heat Map with Contours:



3D Model of the Site:

Our site did not have any stockpiles but did have (14) structures that were scheduled for demolition prior to construction.

There was a 100’ tall tower approximately 250’ south of the flight area that we needed to avoid as well as a hospital helipad within 1 mile that we monitored for activity.

This concludes the sample report.

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.

Written Test

The written 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.

Final Scoring (maximum of 500 total points):

1. Written test (max 100 points)
2. Engineering Notebook (max 100 points)
3. Field A1 (max 50 points)
4. Field A2 (max 50 points)
5. Field A3 (max 50 points)
6. Field A4 (max 150 points)