



## OVERVIEW

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.

## PARTICIPATION REQUIREMENTS

### ELIGIBILITY

- A. Event participants are limited to three (3) teams per chapter 2-3 individuals per team.
- B. AMA youth membership with AMA ID number.
- C. Liability and photo release form
- D. FAA Registration for drones weighting in excess of .55lbs (RubiQ fits in to these requirements)
- E. multiGP Membership (optional)

### ATTIRE

Competition attire, as described in the national TSA dress code is required for this event.

## SAFETY

### FLIGHT SAFETY DURING COMPETITION

- A. Participants are required to wear safety-approved eyewear during the on-site phase of this event. Sunglasses are not suitable.
- B. Pilots may not fly in an intentionally dangerous manner
- C. Pilots may only fly their aircraft within the hot zone of the competition field
- D. Teams may only fly their aircraft when instructed to do so by a field referee.
- E. Pilots will be asked to crash land or ground their aircraft if its flight course poses a threat to any individuals or goes beyond the boundaries of the playing field.
- F. Pilot may only connect a battery to the drone when the drone is on the hot table and told to do so by the chief referee
- G. The transmitter must be placed on the table and remain untouched when a team member is connecting a battery to the aircraft and placing it on the field.
- H. Pilots and spotters will wear eye protection and safety vest when in the flying area.
- I. Drone teams will adhere to all safety rules and directions of game officials.

### HOT AND COLD TABLES

- A. Each competition field will have a hot and cold table. These tables are used for the safety of teams and spectators, allowing them to discern whether or not a team can power their aircraft.

- B. The Cold Table: The cold table is the table on which teams and field officials may place any equipment needed for competition and scoring. At this table teams may handle their drones WITHOUT a battery connected.
- C. The Hot Table: The hot table is the table specifically for a competing team's aircraft, transmitter, or any other items needed only during the flight competition itself. The hot table is the only place a team may connect their battery unless specified for some other reason by a competition official.

### FAA REGULATIONS AND AMA GUIDELINES:

- A. The FAA Advisory Circular 91-57A is extremely pertinent to the outdoor operation UAVs. Please take the time for your team to read this document and abide by its rules during outdoor operation.  
[http://www.faa.gov/documentLibrary/media/Advisory\\_Circular/AC\\_91-57A.pdf](http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-57A.pdf)
- B. When you fly outside, you fly in public airspace which means that no matter the situation, you must ALWAYS GIVE WAY TO THE LARGER MANNED AIRCRAFT. This rule is imperative to the safety of those in the air and the continuation of the UAV hobby in general.
- C. Abide by the Academy of Model Aeronautics National Aircraft Safety Code:  
<https://www.modelaircraft.org/files/105.pdf>
- D. Abide by the Academy of Model Aeronautics National Aircraft sUAS Safety Guide:  
[http://suas.modelaircraft.org/ama/images/sUAS\\_Safety\\_Program\\_web.pdf](http://suas.modelaircraft.org/ama/images/sUAS_Safety_Program_web.pdf)

### DRONES AND PEOPLE

- A. Aircraft may not be armed when being held by an individual.
- B. When configuring an aircraft using the INAV or any other software, it is imperative that no propellers be attached to said aircraft's motors.
- C. Team members may not fly their aircraft over or near other individuals.

### BATTERY SAFETY

- A. Team members should always be present during the charging of a lithium polymer battery.
- B. Follow good LiPo treatment practices:
  - a. Do not discharge batteries below 30%.
  - b. Do not charge batteries above 90%.
  - c. Always Charge and store batteries inside fireproof containers
  - d. Never charge a battery that is puffy or punctured
  - e. Never charge faster than 1C
  - f. Stop Charging immediately if a battery heats up
- C. Lithium Polymer battery fires are chemical fires that do not require oxygen to burn, so if a battery ignites:
  - a. DO NOT POUR WATER ON THE BATTERY. Doing so only makes the fire worse?
  - b. DO NOT PLACE THE BATTERY IN A SEALED CONTAINER TO SMOTHER THE FIRE.
  - c. DO NOT USE A STANDARD HOUSEHOLD FIRE EXTINGUISHER.
- D. If a battery ignites:
  - a. PLACE THE BATTERY IN A BUCKET OF SAND.

- b. THEN COVER THE BATTERY WITH AN ADDITIONAL LAYER OF SAND.
- c. PLACE A PLASTIC BAG FULL OF SAND OVER THE BATTERY.

### DRONE REGULATIONS

#### DRONE SPECIFICATION

- A. Participants are required to provide their drone RubiQ from PCS Edventures
- B. The following is a suggested list of drone and tool box items.
  - i. Extra blades
  - ii. Batteries Charged
  - iii. Drone controller with batteries
  - iv. Power strip for battery charger
  - v. Tools required for working on drone
  - vi. FPV Goggles
  - vii. Extra blades
  - viii. LiPo-safe storage bag
  - ix. LiPo battery charger with balance, charge, discharge and storage functions
  - x. Safety glasses

#### DRONE OPERATION

- A. Team number must be displayed on each drone.
  - a. No bare electrical wiring is allowed.

### DOCUMENTATION

#### PORTFOLIO REQUIREMENTS

- A. The portfolio must have a clear front report cover. The portfolio must include the following single-sided, 8 ½" x 11" pages, in this order.
- B. Title page with contest listed, conference city and state, and year. One (1) page.
- C. Table of contents as needed.
- D. The drones specifications (i.e., engine power, size).
- E. A description and identification of parts.
- F. Flight log.
- G. Rules and Regulations for drones with the FAA registering information and fees.
- H. AMA Registration
- I. Documentation of problem-solving challenging to include the following (see Problem-solving challenging for additional information).
  - a. Problem statement
  - b. Research
  - c. Solution
- J. LEAP Resume

**FLIGHT LOG**

Participant ID#				
Flight #	Date	Flight Time	Drone adjustments	Advisor Sign off
#1				
#2				
#3				
#4				
#5				
#6				
#7				
#8				
#9				
#10				

**CONTEST PROCEDURE**

**WRITTEN EXAM**

- A. Online exam to be taken the day before the skills event. All teams’ members are required to take the exam.
- B. Failure to take the exam will result in disqualification of the team from the skills and racing parts of the contest.
- C. Teams must average a 70% or greater to qualify for the Skills and Racing portions of the contest.
- D. The exam will consist of 50 multiple choice questions that will cover: Rules and Regulations, safety, and Terminology.

**PROBLEM-SOLVING CHALLENGE**

- A. Each Team will identify a problem in their schools, community, city or state and develop a conceptual solution that positively utilizes drone technologies.
- B. Teams will present their project to a panel of judges for evaluation and feedback. Each presentation will last a maximum of ten (10) minutes, including Q&A.
- C. Teams may produce prototypes and of visual aids such as displays boards. Teams may present a video or PowerPoint presentation but must provide their computer and projector.
- D. Evaluated on the quality of the team’s research, the level of innovation demonstrated, and the quality of the presentation itself. See the Rubric for specific aspects of judging.
- E. Only student team members may present to the judges.

**FLIGHT CHALLENGE GENERAL RULES**

- A. Participants report to the event coordinator at the time and place stated in the conference program to sign up for the flight times.

- B. Teams must pass the written exam to be eligible for the semifinalist skills/racing portions of the contest.
- C. 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 runtime will be recorded for that flight.
- D. Each team will work from a command center (hot table) to remotely operate the drone. You may stand in front of the command table. You will place the drone at the starting position as directed by the judge.
- E. If your drone flies outside of the field parameters, that flight will not count, and the judges may disqualify you.
- F. Each team must keep their drone in the line of sight and have control of the drone at all times.
- G. Your drone may not enter the challenge field while another team is flying.
- H. Take-off and landing: Teams must be capable of executing take-off and landing from a rough mown grass runway
- I. Conduct of the UAV Pilot
  - a. The UAV Pilot is responsible for launching and recovering the aircraft and the safe piloting of the aircraft once it is airborne. At all times while the aircraft is airborne the UAV Pilot must have a handheld radio control transmitter for the aircraft and be able to activate flight termination mode.
  - b. The UAV Pilot must control the aircraft such that it remains in the flying zone. Spotters on the course will determine if the aircraft flies outside the flying zone.
- J. Airspace incursion procedures:
  - a. Flying into the No-Fly Zone: If the aircraft is deemed to have flown into the no-fly zone, then the Range Safety Officer will direct the UAV Pilot to land the aircraft without delay. The Range Safety Officer is responsible for the safe operations of the event. Upon landing the aircraft, the Range Safety Officer will direct the team to vacate the field. The no-fly zone is designed to protect the general public, organizers, and teams.
  - b. Exiting the Flying Zone: If the aircraft is deemed to have flown outside the flying zone (excluding the no-fly zone), then the Range Safety Officer will direct the UAV Controller to land the aircraft without delay. Upon landing the aircraft the Range Safety Officer will give a verbal warning to the UAV Controller. The clock will remain running throughout this process. The UAV Controller is allowed two warnings. If the UAV leaves the flying zone a third time, the Range Safety Officer will direct the UAV Controller to land the aircraft and to vacate the field and their mission time will be declared over.
  - c. The UAV Controller must adhere to the flight circuit procedures provided at the competition.
  - d. Safety Inspections
    - i. Static safety inspections will include (but not be limited to) the following:
    - ii. Structural verification of the aircraft to ensure structural integrity including,
    - iii. Components adequately secured and fasteners tightened
    - iv. Propeller structure and attachment integrity

- v. Inspection of all wiring
- vi. Controls move as expected
- vii. Radio range checks with motor/s off and on;
- viii. Flight termination behavior tested (transmitter switched off);

### SKILLED FLIGHT CHALLENGE

- A. The Skilled Flight Challenge will consist of three mini-challenges. A team's Flight Challenge Score will be the sum of their scores from each mini-challenge. The Skilled Flight Challenge will consist of three levels.
  - a. Level I: Novice – Pilots will fly around a flag and land in a designated area
  - b. Level II: Intermediate – Pilots will pilot their drone around a simple slalom course (two flags) and land in a designated area.
  - c. Level III: Advanced – Pilots will fly a course of gates, and slalom flags and land in a designated area
- B. All Skilled events will be a timed event and teams will receive time penalties.
  - a. Level I: one minute
  - b. Level II: Two minutes seconds
  - c. Level III: three minutes
- C. Each team will be assessed a five (5) point penalties for every five (5) seconds over time.

### DRONE EXHIBITION RACE

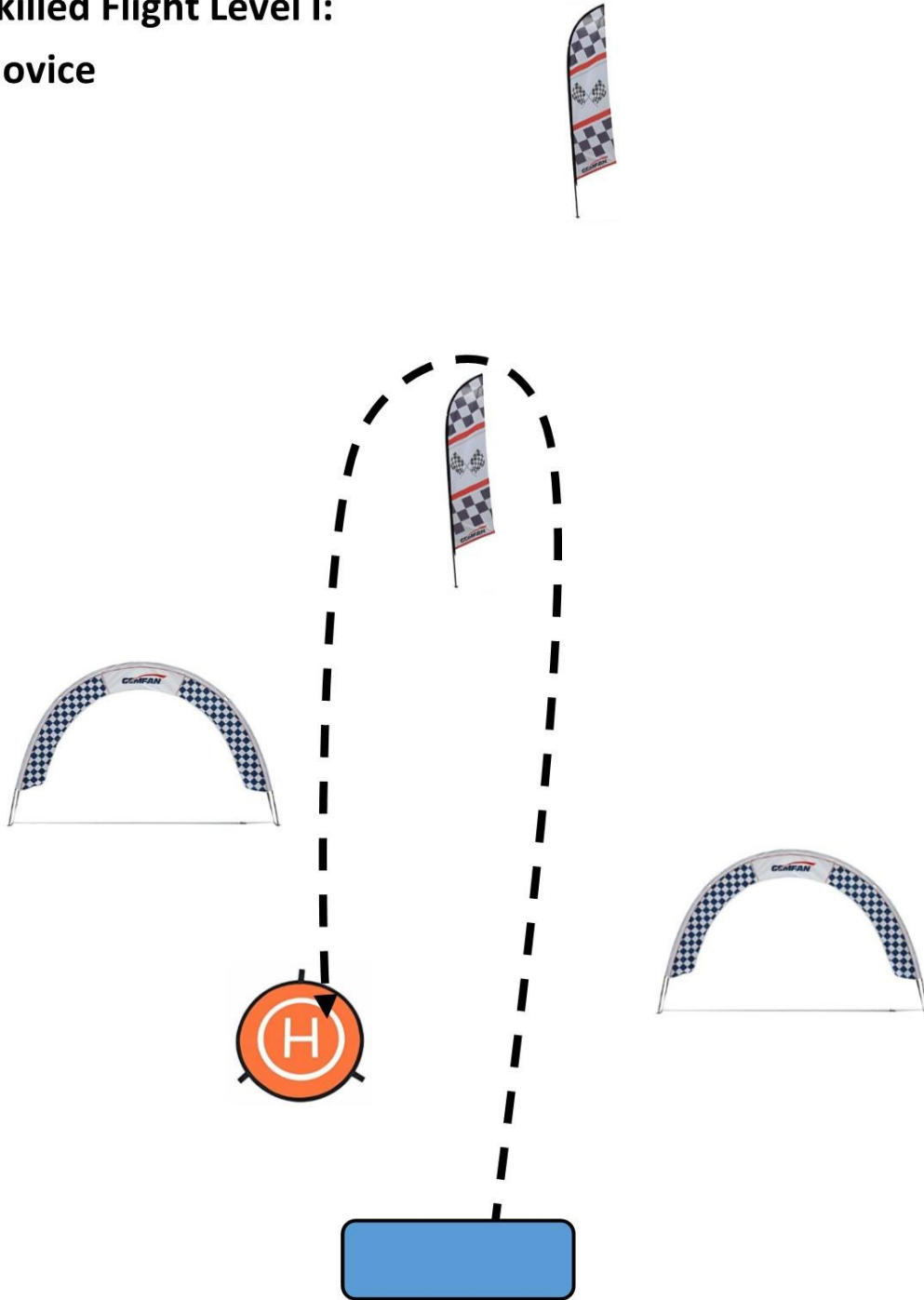
- A. Teams that qualify for the skilled flight challenge have the opportunity to test their skills on a Drone race course.
  - a. Teams will flight an individual timed race.
  - b. Each team will be given three minutes to complete as many laps of the course as possible.

### AWARDS

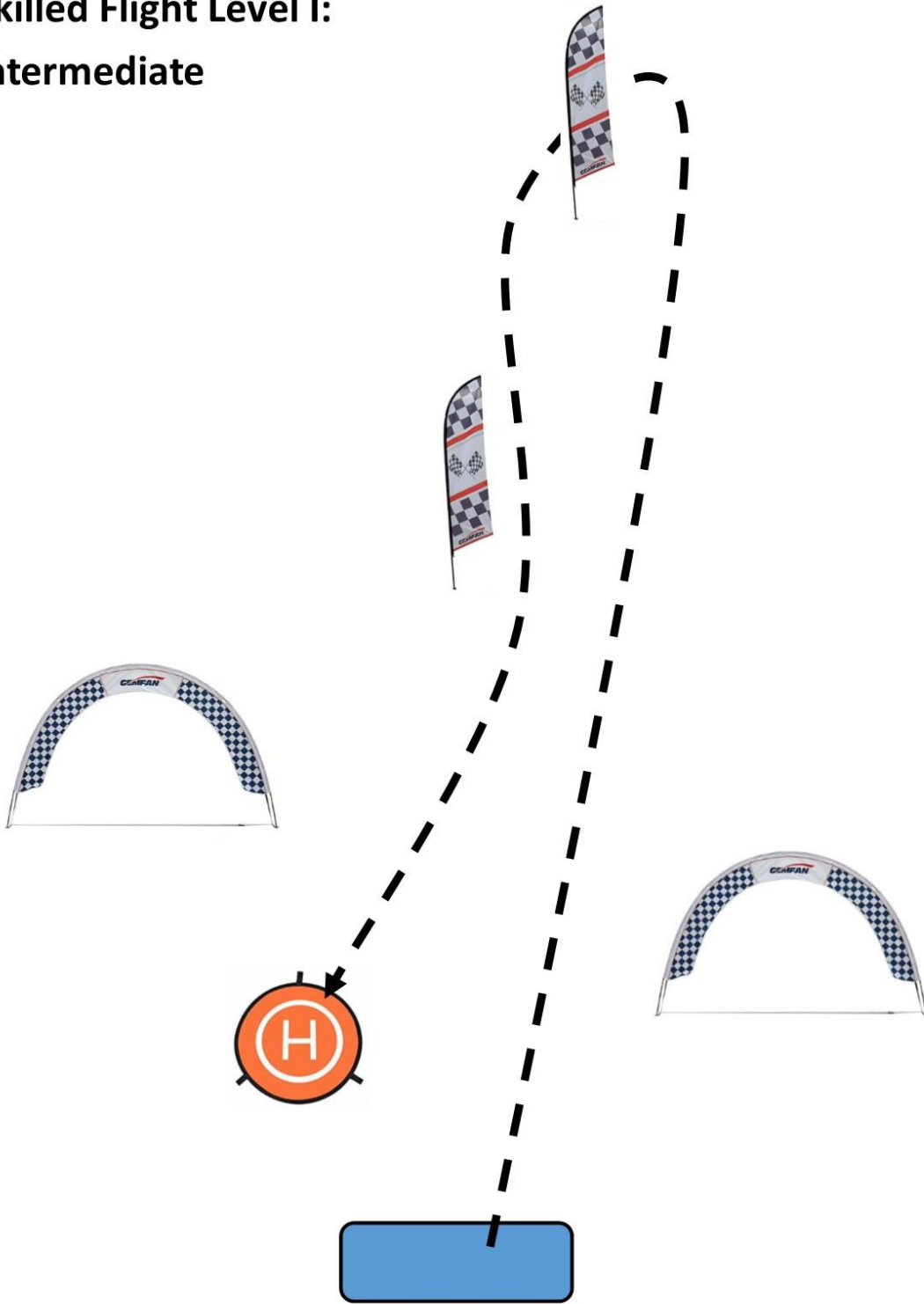
- A. **Problem-Solving & Research Award:** The team that best demonstrated the fulfillment of the Problem-solving Project criteria described in Section 5 as determined by the judges.
- B. **Skilled Flight Award:** The team with the highest score in the flight challenge among all teams in all Drone Groups.
- C. **Champion's Award:** The top three overall teams overall.
- D. **Champions Award Determination:** Each of the DFG challenges will be equally weighted (

SKILLED FLIGHT COURSE LAYOUTS

**Skilled Flight Level I:  
Novice**

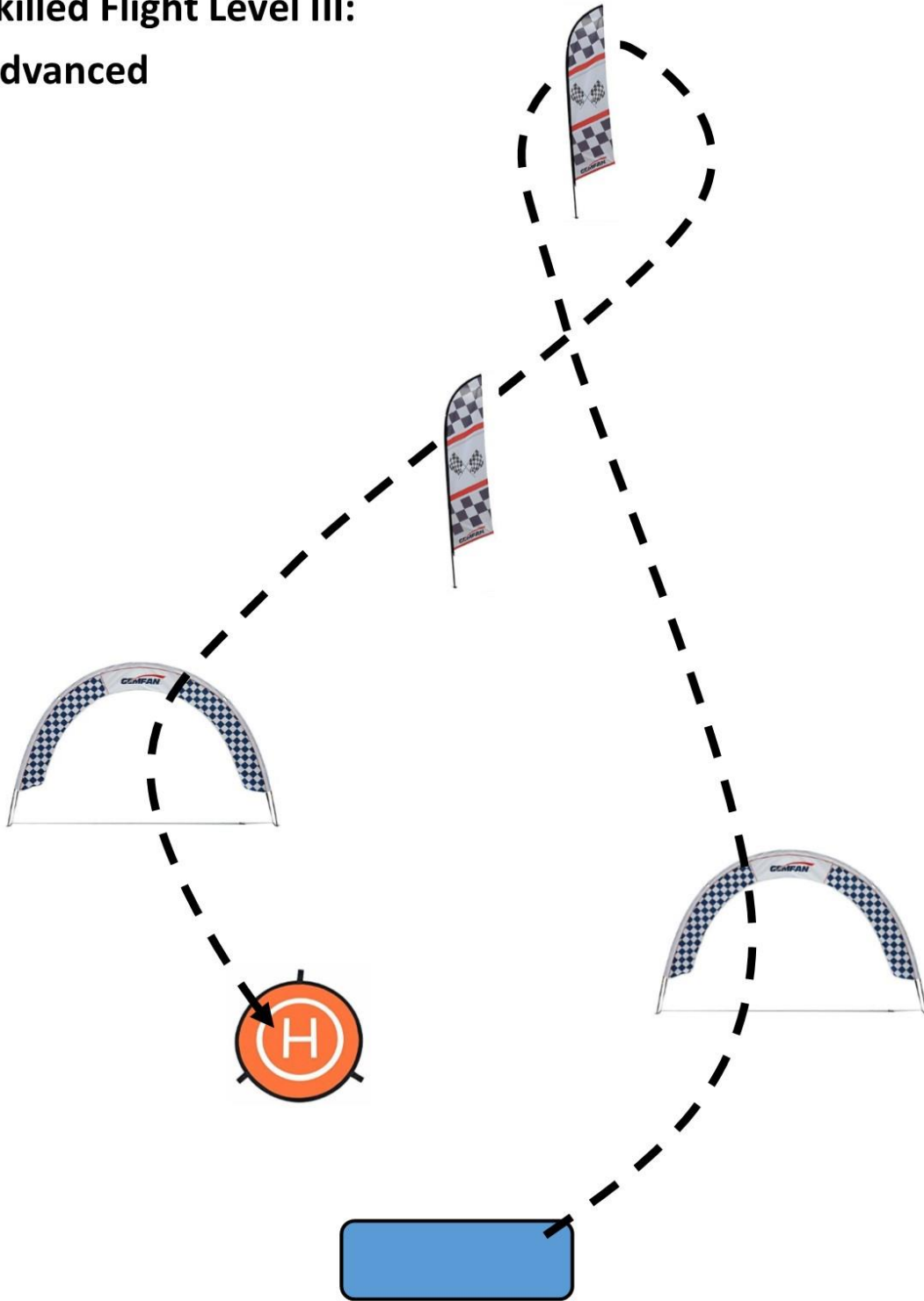


# Skilled Flight Level I: Intermediate





# Skilled Flight Level III: Advanced



Participant ID#1 \_\_\_\_\_ ID#2 \_\_\_\_\_ ID#3 \_\_\_\_\_

Drone Technology Rubric		
2017 & 2018 Official Rating Form		High School
Team Written Test (50 points)		
Record the scores of the three (3) team members in the boxes below. Calculate the average of their scores. Divide the average by three (3) for the score that the team will receive out of the fifty (50) points. Record the score in the column space to the right.		
#1	#2	#3
SUBTOTAL (50 points)		

Record scores in the column spaces below.

Documentation (100 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Evaluations: Using Minimal (1-4 points), adequate (5-8 points), or exemplary (9-10) performance levels as a guideline. 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 criteria = 7 points; an "adequate" of 7 for a X2 criteria = 14 points. A score of zero (0) is acceptable if the minimal performance for any criterion is not met.)			
Portfolio components (X1)	The portfolio is unorganized and is missing three or more components.	Portfolio has most components and is organized; It has sufficient content	All components are included in the portfolio; content and organization are excellent
<u>Technical data</u> (x1)			
Description and identification of parts (x1)			
Flight log (x1)			
Rules and Regulations (x1)			
AMA Registration (x1)			
MultiGP Registration (optional)			

Record scores in the column spaces below.

Problem Solving Challenge – Problem Statement (x1)				
Problem Solving Challenge – Research (x1)				
Problem Solving Challenge – Solution (x1)				
<b>SUBTOTAL (100 points)</b>				

Problem-Solving Challenge (70 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Problem statement (x1)	The portfolio is unorganized and is missing three or more components.	Portfolio has most components and is organized; It has sufficient content	All components are included in the portfolio; content and organization are excellent
Effectiveness of Design (x1)			
Aesthetic appeal (x1)			
Creativity and innovation (x1)			
Research (x2)			
<b>SUBTOTAL (60 points)</b>			

Presentation (80 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Organization</b> (X1)			
<b>Knowledge</b> (X2)			
<b>Articulation</b> (X1)			
<b>Delivery</b> (X1)			
<b>Team participation</b> (X1)			



LEAP Leadership Resume/Interview See Regulation E and instructions on TSA website (X2)				
<b>SUBTOTAL (80 points)</b>				
Flight Challenge (60 points) Flight times recorded to the nearest tenth (.1) of a second				
Level I: Novice (20 points)		Seconds		
Level I: Intermediate (20 Points)		Seconds		
Level I: Advanced (20 points)		Seconds		
<b>SUBTOTAL (60 points)</b>				
Time penalty (5 points for every 5 seconds over allotted time)				
<b>Total (300 possible)</b>				