

The 2022 UAV Everglades Defender Challenge

- **OVERVIEW:**

The mission of your team is to design, build, assemble, document and test fly an open source Unmanned Aerial Vehicle drone that finds by non-indigenous species of snakes. The Florida Everglades is being invaded by non-indigenous species of snakes, such as pythons. These snakes are having a serious impact on indigenous wildlife and the ecosystem of the Florida Everglades. Recently a Python over 17 was captured and was carrying 84 eggs and this population of snakes is out of control. Your mission is to eradicate the located snakes by dropping to a small animal, laden with an explosive device on top of the snake or within 4" and then ignite the explosive device.

The UAV Everglades Defender Challenge competitors must successfully simulate this search and eradicate process in this competitive event. **YOU ARE TO ENGINEER AND BUILD an OPENSOURCE UAV Drone.** This UAV DRONE will be able to drop a small rubber toy mouse onto or within 4 inches a small rubber toy snake that it finds hidden on the competition field. Once the rubber toy mouse has been dropped, then the drone is to turn on an onboard light signally the toy mouse was detonated. Points will be tallied for the most successful drops and detonations.

- **INTENT OF COMPETITION:**

It is important to understand this event incorporates aeronautical engineering, electrical engineering, and mechanical engineering in a hands-on design, build and fly student UAV Quadcopter competition. **This competition strives to focus students on solving real world UAV Drone challenges by engineering, fabrication, and testing.**

- **ELIGIBILITY:**

- 2 Teams of 2 to 6 members per team per chapter
- Competitors are to Engineer, Build, Test, and Operate OPENSOURCE Unmanned Aerial Vehicle UAV Drone based on the provided specifications in this document.

- **PROCEDURE:**

- When UAV Drone is out of the competition tent area, all propellers must be removed. NO EXCEPTIONS.
- Present UAV Drone (quadcopter) Portfolio (see required contents of portfolio)
- Present UAV Drone for inspection and interview.
- Be ready for coordinator and judges to ask questions about UAV Drone build.
- Pit Area Assignment. The Event Coordinator will provide a designated area for UAV Drone Teams to work on and prepare their UAV Drone for flight.

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- First, seek and locate snakes **OR** proceed to the load station
 - After the rubber rat payload is acquired by the UAV Drone seek to find and drop payload.
 - Drop rat payload on or within 4 inches of snake.
 - Turn on a light onboard the UAV Drone simulating the payload was detonated.
 - Repeat the process until **all 5 snakes** are eliminated.
 - Repeat until all rats have been successfully dropped on our near snakes.
 - Fly back to launch stations
 - Interview with judges regarding design, fabrication, programming, and pilot training with portfolio review.
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- **ATTIRE:**
TSA competition attire is required for this event.
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- **REGULATIONS:**
 1. **SAFETY IS MOST IMPORTANT!**
 2. When a team member enters the competition tent field, only at the direction of the event coordinator may the team members attach the battery cable and turn on their UAV Drone and become ready to fly.
 3. The event coordinator will inspect the UAV Drone mounted propellers to ensure safe operation.
 4. When A UAV Drone is outside of the competition tent area, all batteries must be unplugged from the UAV Drone stack, which should consist of the flight controller receiver and the Electronic Speed Controller (ESE). **NO EXCEPTIONS.**
 5. When the competition and when practice session is under way and a UAV Drone is in the competition field area flying all UAV Drone in the pit area or outside the pit area must be **POWERED OFF**. This is an Automatic 10 Point deduction if this occurs.
 6. All batteries will be inspected prior to flight practice and the competition.
 7. All UAV Drones must fly **ONLY** with the Competition field.
 8. Landing gear should be adjustable or adaptable in size to cover a variety of mission requirements and payload sizes.

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9. All competitors must provide, at UAV Drone judges inspection a 2" (minimum) white binder UAV Drone Engineering Portfolio Binder with clear transparent front and back covers.
 10. The UAV Drone portfolio binder front cover (in the front sleeve of a minimum 2" binder) must have:
 - The competition Name "The 2020 UAV Drone Everglades Defender".
 - The city name where the Florida TSA State competition is held.
 - Blank line for team identification number to be filled in prior to UAV Drone inspection by the judges.
 11. A UAV Drone Team must consist of 2 – 6 competitors performing the following roles (each team member must wear an adhesive badge on shirt of their role...names not allowed):
 - Pilot
 - Mission Specialist
 - Flight Mechanic
 - Power Manager (controls all the electric charging stations and batteries).
 - UAV Drone Engineering and/or Designer (1-2 persons).
 - UAV Drone Equipment Manager
 - UAV Programmer
 - Team Manager
 - Back up pilot
 - Back up mission specialist
 - Back up flight mechanic
 - Command and Control Specialist and Spotters
- **UAV DRONE SPECIFICATIONS:**
 - a. Competing Unmanned Aerial Vehicles UAV Drone **MUST HAVE** four motors and four propeller blades.
 - b. UAV Drone **must be assembled from open-sourced parts**. The UAV Drone can be purchased as a kit that can be built, reconfigured, changed, and modified with different components.

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- c. The UAV Drone frame structure can be made from plastic, wood, 3D printed materials (carbon fiber, PLA plastic, ABS plastic, resin, metal combined plastic or resin). Parts can be purchased commercially and modified. **NO COMMERCIALY AVAILIBLED DRONE WILL BE USED IN THE COMPETITON (i.e., Mavic Pro or Mavic Mini) OR PRACTICE SESSIONS.**
- d. Competitors must document all components in their open-source bill of materials (BOM) and spread sheet in their portfolio binder of their UAV Drone.
- e. Competitors must provide a wiring schematic drawing of their UAV Drone components (modules) in their portfolio binder with associated wiring of component to components. Identified voltages would be an advantage.
- f. Competitors must provide an ANSI orthographic/iso projection (top, front, right & isometric views) of their competing UAV Drone, with all dimensions that define their UAV Drone. Competitors may have 1-4 drawings or more that define their competing UAV Drone in the Engineering Portfolio Binder.
- g. Competitors must document in their portfolio, a photo log (4"x 6" printed photographs mounted to an 8.5" x 11" paper inside of a clear sheet protector) of each step of their build. From motors to frame mount to final flight ready UAV Drone. Showing all steps of mounting electronic speed controllers, video transmitters, flight controllers, cameras, antennas, etc., all being mounted and wired.
- h. Competitors must document in their portfolio flight programming software for flight functioning and stabilization. (i.e., Q-Ground Control, Beta flight, etc.). Plus, any additional software and hardware used for mission function (robotic software, microcontroller software for Arduinos, raspberry pi, etc.).
- i. Battery packs must only be commercially available lithium-ion batteries that are purchased from open-sourced 3rd parties (i.e., Amazon, hobby shops, etc.).
- j. In the pit area, battery chargers and batteries, as they are being charged, must be placed on the fireproof welding blanket in the Pits Charging Area. The welding blanket will be provided by the coordinator.
- k. The UAV Drone propellers can be in size from 4" (101mm) to 8" (152.4mm) in overall length.
- l. The specified acceptable functioning size of the UAV Drone, the UAV Drone will be measured diagonally, from the outer side of the propeller shaft upper left to the outside lower right propeller shaft or vice versa.
 - Sizes can be from 5" (250mm) to 16" (304mm) in outside motor propeller size diagonally. These sizes encourage creativity and advanced design.

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- The UAV Drone can optionally use propeller guards but must fit inside a 20" x 20" go-no-go box for pre-flight inspections by the judges.

- **The UAV Drone Competition Specifications:**

1. No batteries are to be plugged into the UAV Drone outside of the competition area, unless approved by the coordinator, with propellers off the UAV Drone to test and determine the UAV Drone is operational.
2. Pit location is on a first come, first serve basis as determined by the Event Coordinator.
3. Teams bring to pit area, for inspection, primary UAV Drone and a backup UAV Drone, radio controller(s), chargers, batteries, welding blanket(s), tools box, power strip, 3-prong electrical extension cord, replacement parts, spare parts and tools and the UAV Drone Engineering Portfolio Engineering and all necessary computers and associated software for the competition.
4. All equipment, portfolio, tools, chargers, and computers are to be arranged for inspection and safety check. Upon completion of the inspection students will be at their pit area for an interview question and answer session for the judges. Adhesive badges will be provided to designate UAV Team roles and responsibilities.
5. Team members must have the adhesive badge on their shirt, with role, function team identification number **ONLY**. No names are to be listed.
6. Florida TSA will provide radios for spotters, pilots, and mission specialists. Teams may bring their own radios for spotting purposes only and no communication to outside event people.
7. Judges will check UAV Drone start up and motor reviving at the end of the inspection in the competition field area only.
8. Judges will check to see if UAV Drone meets competition and specifications.
9. Teams will be given a one-time 30-minute session to correct any problems to prevent disqualification for not being competition flight ready.
10. Teams will be assessed as to ready to fly for practice sessions and .
11. While all competitors in the flight competition area, UAV Drone and radios in the pit area are to be turned off and powered down. Ask the coordinator if it is clear to test radio controllers, so no accidents occur with your team or other team's UAV Drone.
12. Start of Pre-flight check:
 - **ONLY**, the flight mechanic will bring to the competition area the UAV Drone with necessary tools, propeller mounting nuts and the four mounted propellers and batteries are not connected the Flight Controller and Electronic Speed Controller (ESC) stack.

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- Pilot will pretest the UAV Drone, at the event coordinator's direction the motor spinning up and revive test with propellers mounted in closed tent area.
- Once a successful spinning and revive test is successfully completed, then, at the event coordinator's direction, the pilot and the mission specialist will be able practice or start the competition round.

13. The Mission:

- The search and find mission: 15 minutes.
- Pilot will fly UAV Drone via FPV or visual flight methods. The Mission Specialist must use FPV (goggles, video screen, phone, etc.) to identify targets and complete payload load and drop operations.
- Start from the launch station, search, and find snakes or proceed first to the load station and then search for snakes to eradicate.
- Spotters can communicate the UAV Drone location to the pilot and mission specialist. These areas will be covered to prevent spotters from seeing the possible location of the snakes.

14. Judges and coordinator will tally up the successful drops onto the located snakes.

15. Judges and the event coordinator in the case of a tie will rearrange the challenge to increase the difficulty of the mission for a tiebreaker to determine the Everglades Defender winner.

16. COMPETITION FIELD & COMPONENTS:

- **The competition field** is a large wedding tent frame covered with bird netting. This will keep any errant UAV Drone from causing dangerous injury and problems to fellow competitors, judges, and spectators
- The field will have a **matrix of board panels** erected that will hide or show the snakes that will be only visible from the UAV Drone. The use of wooden boards will allow the coordinator to hide or disclose the rubber snakes as targets.
- The **Loading pad** is a board with a single rubber rat placed on the board in which a drone can safely land and load onto the UAV Drone. Magnet or grippers. As a UAV Drone leaves the Loading Pad, the coordinator will place another rubber rat onto the loading pad.
- **Spotter Radios** will be supplied to all competitors to allow designated spotters to communicate with the UAV Drone pilot and Mission Specialist. Spotters can be stationed around the competition field to aid in the mission.
- **UAV Drone Pit Area** will be located behind the competition field with tables for teams to show their UAV Drones to judges and the coordinator.

Any questions email, text or call Richard Platt (941) 538-1630 or plattr@manateeschools.net

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- UAV Drone competitors must have their own **power strips and extension cords** to charge their batteries.
- UAV Drone competitors must have their own **tools and soldering irons, computers, and spare parts**.

17. JUDGING RUBRIC:

UAV DRONE and UAV DRONE ENGINEERING PORTFOLIO:

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
UAV DRONE ENGINEERING PORTFOLIO BINDER	1-4 points Portfolio outline components are missing significant detail is lacking building, design, and operation the UAV Drone	5-8 points Portfolio outline components are included in binder with minimum and adequate information. Including minimal photos, drawings, and schematics.	9-10 points All portfolio outline components are included in binder with sufficient and detailed information. Photos, drawings, and schematics	

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
UAV DRONE SOURCING & BUDGET	1-4 points Little or no information of components, parts, and materials to build and operate the UAV Drone.	5-8 points Partial budget & spreadsheet of components and parts in order to build and resupply any component of each UAV Drone without optional sourcing of materials.	9-10 points: Complete budget & spreadsheet of components, and parts in order to successfully build and resupply any component of each UAV Drone with optional sourcing of materials.	

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
UAV DRONE Roles and Responsibilities	1-4 points Little or no information of specific roles and or responsibilities for the UAV Drone team. Little or no reports or work logs.	5-8 points Minimal information and explanation of roles and responsibilities. Combined with work logs and reflective experiences and skills learned.	9-10 points Detailed information and explanation of roles and responsibilities. Combined with work logs and reflective experiences and skills learned.	

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CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
UAV DRONE Fabrication Assembly Lab work area	1-4 points Little or no photographs of UAV Drone assembly work area. No photographs of tools and supplies.	5-8 points Minimal photographs and documentation of UAV Drone assembly work area. Some photographs of tools, work benches and assembly area.	9-10 points Detailed photographs and documentation of UAV Drone assembly work area. Detailed photographs of tools, work benches, assembly area and storage.	

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
UAV DRONE Drawings, Schematics and CAD (Computer Aided Design) drawings and Drawings	1-4 points Little or no Drawings, Schematics and CAD Renderings	5-9 points Minimal Drawings, Schematics and CAD Renderings. Lacking detailed engineering drawing details would make rebuilding UAV Drone difficult. Drawings match minimum specifications to accurately to actual UAV Drone	10-20 points Detailed Drawings, Schematics and CAD Renderings showing all technical illustrations necessary to operate and or rebuild current competition UAV Drone. Documentation of Stereo Lithography models for 3D printing.	

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
UAV DRONE Preflight Inspection	1-4 points Little or no Drawings, and Schematics to verify UAV Drone was not built according to the competitor's design. UAV Drone is not flyable and cannot be repaired in pits to fly. UAV Drone does not meet minimum and maximum competition flight specifications. UAV Drone cannot successfully fly in practice session and or repaired to fly.	5-9 points Minimal Drawings and Schematics to verify design build was per plans. UAV Drone meets minimum and maximum requirements. UAV Drone is flight ready. All components are not fully operational, but UAV can fly. Competitor(s) cannot fully explain design intent and engineering processes. UAV Drone can successfully fly in practice session.	10-20 points UAV Drone is flight ready with all components as per engineering drawings and schematics. UAV Drone Competitors explain design intent and how design was built and tested. UAV Drone is fully operational. UAV Drone can successfully fly in practice session.	

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CRITERIA	Minimal performance	Adequate performance	Exemplary performance	TOTALS
Everglades Defender Challenge performance	<p>1-4 points UAV Drone was not flyable and or did not complete any mission by successfully eradicating one snake.</p> <p>Each successful drop is worth 10 points.</p>	<p>5-9 points The mission was a success in successfully dropping rats loaded with explosive charges within 4 inches of the identified snake(s) signaling the charge exploded by turning on a light on their UAV Drone. Successfully dropped explosive rats on all 5 snakes. Each successful drop is worth 10 points.</p>	<p>10 – 50 points The mission was a success in successfully dropping rats loaded with explosive charges within 4 inches of the identified snake(s) signaling the charge exploded by turning on a light on their UAV Drone. Successfully dropped explosive rats on all 5 snakes. Each successful drop is worth 10 points.</p>	

- Teams and competitors exhibiting good sportsmanship, mutual respect and mutual support between competitors are encouraged and extra points will be awarded by judges.
- Point Deductions – Per judge's discretion. _____
- Total Scoring _____

Sample Flight and Work Log:

Date of Work Log: _____

UAV Drone Number and identifier:

Mechanic:

Pilot:

Mission Specialist(s)

Programmer:

CAD Engineer/Designer:

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Spotter(s):

Team Manager:

Action (check all applicable):

<input type="checkbox"/>	Build	<input type="checkbox"/>	3D Print(s)	<input type="checkbox"/>	Practice Flight
<input type="checkbox"/>	Bench Test(s)	<input type="checkbox"/>	Battery Charging	<input type="checkbox"/>	Binder
<input type="checkbox"/>	Program	<input type="checkbox"/>	Setup Field	<input type="checkbox"/>	Other:

Define Other Actions:

Flight Test and Practice Results:
