SIMNET

UAS4STEM

DRONE ENGINEERING CHALLENGE

NEW TEAM GUIDE

If you have questions about the UAS4STEM program, please contact the Education Department at AMAUAS4STEM@modelaircraft.org or (765) 287-1256, extension 517

VERSION 2.3

UAS4STEM

What does it take to be a UAS4STEM team manager?

You don't need to be a drone expert, and you don't need to have all of the answers. What you do need to have is the ability to care about your team and guide students as they seek answers. You will help students prioritize goals and cultivate a positive team dynamic. Most importantly, you will provide a safe, fun, and educational environment. **In short, you inspire.** One of the most rewarding aspects of becoming a UAS4STEM team manager is being able to witness the incredible growth of the students in your care.

Thank you for taking on this role. It's my honor to welcome you to the UAS4STEM competition!

Sincerely,

Kyle Jaracz, AMA Education Director

Kyle Jaracz (far left in blue) congratulating the Advanced Division first-place team, Some Assembly Required, during the awards presentation at EAA AirVenture 2024.

WHAT IS UAS4STEM?

UAS4STEM is a drone engineering challenge like no other! Students work in a team to build, program, and fly a drone. With both Beginner and Advanced divisions, it's a competition for everyone that allows you to participate from anywhere in the world!

Each season mission challenges are presented. These challenges require teams build a drone to specifications and learn how to program it for autonomous flight in order to be successful. All students complete UAS4STEM's virtual ground school course to learn the basics of safe and legal drone operations in the national airspace.

The virtual preliminary competition, held in the last two weeks of April, gives students the chance to showcase their mission readiness before a panel of judges. Students deliver a presentation about their progress, answer questions, and program a mock mission to prove their knowledge of safe and autonomous drone operation.

Beginner teams focus on learning to fly missions that focus on search/inspection. Advanced teams face the additional challenge of designing and fabricating a mechanism for their drone to complete a specific task during the competition. We encourage new teams to start in the Beginner division. This helps ensure that your students have the time and resources to accomplish the tasks at hand. You may opt to enroll in the Advanced division based on your students' skillsets.

Top-scoring teams from the preliminary competition are invited to compete in-person at the championship competition, which takes place at the Experimental Aircraft Association's EAA AirVenture in Oshkosh, Wisconsin, at the end of July.

See full competition details at www.uas4stem.org.

ELIGIBILITY

Students ages 11-19 are eligible to compete.

Teams must consist of between four and ten students. There are also two adult team manager positions.

All registration costs must be paid by March 31, 2026 to compete.

BENEFITS OF COMPETING

Participants of UAS4STEM become members of the Academy of Model Aeronautics (AMA). Membership includes liability insurance related to model aircraft operations and opens access to thousands of chartered clubs across the United States. The lead team manager also gains membership to the Experimental Aircraft Association (EAA).

Trophies and $9,000 in total cash prizes are awarded to the first, second, and third place finishers in both the Advanced and Beginner categories at the championship competition.

UAS4STEM students display growth in career-focused skills, including approximately 100 hours of technical experience, leadership development, communication, problem solving, increased self confidence, and positive interactions with aviation professionals.

Participants also gain access to Ardupilot Mission Planner certifications through our partner, SIMNET.

INVESTMENT

Begin your UAS4STEM experience for only $299, and then pay the remainder of the balance ($1,196). *(Note: we offer a 50% discount for additional teams.)*

A one-time investment is needed to purchase drone components. You can source your own components based on the drone specifications list, or find kits that are produced by third-party sellers like ReadyMadeRC ($1,162.59) or a QuadzillaDrone ($1,699).

Other equipment (laptop, tools, etc.) is required.

Teams advancing (by invitation) to the in-person championship are responsible for travel costs to AirVenture in Oshkosh, WI. Admission and campsites for AirVenture are provided by our partner, the Experimental Aircraft Association, at no cost for teams and up to 5 accompanying adults. Camping equipment (or alternative lodging arrangements), meals and other miscellaneous expenses are the responsibility of each individual team.

Local fundraising can be a great way to defray the costs associated with the competition.

SUGGESTED TIMELINE

Phase 1: Foundation *(September - November)*

Goals: Register your team, understand the mission, and learn the fundamentals.

- Register Your Team: Sign up at UAS4STEM.org. *All registration costs must be paid by March 31, 2025 to compete.*
- Assemble Your Crew: Form a team of 4-10 students *(ages 11-19)*. Submit the team roster. This information is used by AMA staff to process memberships and to create login credentials for the virtual ground school course which will be sent to you via email. ***(Check the "Team Roles" section for advice!)***
- Rulebook Deep Dive: Read your division's rulebook from cover to cover.
- Start Ground School: To ensure safety, all student team members must pass the UAS4STEM ground school course prior to the preliminary competition. Some teams go through the material together as a group, while other teams require students to complete it on their own time. This course teaches the basics of drone operations in the US and can serve as a Part 107 FAA drone operator license preparatory course.

Phase 2: The Build *(December - February)*

Goals: Procure parts, build your drone, and fly safely.

- Purchase competition-compliant drone (UAS) components. This could be a UAS4STEM bundle from a manufacturing partner or a DIY using the specifications list located in the Appendix of the rule book.
- Build the Drone: Assemble the quadcopter. The drone should be built and maintained primarily by students. We recommend starting early. A step-by-step build video and auto pilot setup video are available. Reach out with any build questions to archies@modelaircraft.org.
- Set Up Your Ground Station: Designate a laptop for your ground control station (GCS) and download the free ArduPilot Mission Planner software. This software is used to program autonomous flight. Students will gain access to SIMNET's Mission Planner training. Mission Planner knowledge is crucial for success in this competition.

(Advanced teams: Begin designing and prototyping your payload delivery mechanism. It must be a custom design, not a commercial kit.)

Finalists attending AirVenture, taken prior to the Wednesday night airshow and awards presentation.

TEAM ROLES

Team Manager
The adult mentor who oversees the team's overall strategy, organization, and performance, ensuring that objectives are met and resources are allocated effectively.

Assistant Team Manager
Supports the team manager in coordinating team activities and logistics, stepping in as needed to maintain continuity and focus.

Remote Pilot in Command
The designated pilot responsible for the operation of the drone during flight, making critical decisions related to navigation, safety, and mission execution.

Safety Pilot
A trained pilot who assists the RPIC by monitoring flight conditions and maintaining situational awareness, ready to take control if necessary to ensure safety. An adult may act as the safety pilot for drone test flights during training, but this role will need to be transferred to a student team member for the actual flight operations during the competition. The safety pilot should be someone who can fly the aircraft manually using a radio control transmitter.

Visual Observer
A team member tasked with maintaining visual contact with the drone during flight, providing real-time updates on its position and surroundings to enhance situational awareness.

Safety Officer
Responsible for enforcing safety protocols and procedures, ensuring that all team members adhere to safety guidelines and managing risk during operations.

Ground Station Officer/Flight Operations
Manages the ground control station, including communication with the RPIC, monitoring telemetry data, and executing flight plans to support mission objectives.

Phase 3: Test & Refine *(March - April)*

Goals: Practice the mission, finalize documentation, and prepare for the virtual preliminaries.

- Find a Flying Site: You should find an area with enough space to safely operate your UAS. You will also need to ensure that the airspace is designated for UAS operations. You can learn more by visiting the FAA's B4UFLY page. Remember that you and your team are AMA members and can reach out to existing AMA clubs by using the AMA Club Finder. Use the provided contact to ask about space for your team to fly.
- Practice, Practice, Practice: Conduct test flight operations and practice missions. We provide files so you can print your own practice resources. A test mission and sample judging sheets can be found in the rulebook.
- Produce a student-created short video that showcases the team and competition (details in the rulebook). This will be included in the team's Flight Readiness Review (FRR) presentation.
- Prepare the FRR: Prepare and rehearse your Flight Readiness Review presentation. Contents and scoring are outlined in the rulebook. This should be a live (not prerecorded), spoken presentation that also uses media (such as a slideshow and the scored student-created video) to convey information. Sample presentations are available for you to view online.

Competitors have many chances to share ideas and collaborate across team lines during the challenge.

YOUTH SAFETY

Please take a moment to review some safety recommendations. Pay attention to and incorporate any local/organizational requirements.

- Complete background checks for all adult participants.
- Consider child abuse prevention training. These will differ between states, so we recommend researching the requirements of your state.
- Never be one-on-one with a youth. Ensure that there are other people around.
- Have a clear set of rules that are on display and easily accessible for your attendees/participants, and make sure that you enforce these rules.
- Consider sending a Code of Conduct that formal participants must sign prior to attending specific events. Some of these rules may include: following basic safety rules, not possessing dangerous substances, exhibiting good sportsmanship, and treating all individuals and equipment with care and respect.
- Have a comprehensive written child protection policy.
- Ensure that adults working/volunteering understand their roles and responsibilities.
- Limit communication to sharing program information through the following: telephone calls or texts to the parent's telephone (not the youth's mobile phone), emails addressed to both the youth and their parents, and written information sent to the parents' home.
- Always report suspicions of abuse, neglect, or injury to the appropriate authorities and guardians.

PRELIMINARIES

UAS4STEM staff will coordinate with the team manager to establish a time slot that fits your schedule. The rulebook contains details necessary to compete. This is a 50-minute virtual session with judges that includes the following:

Flight Readiness Review (FRR) presentation: The team is welcomed and will appear on camera to give a prepared presentation.

Five questions: For the Beginner division, the judges will ask five different scored questions selected from the ground school course.

Question and answer: The judges may ask questions regarding the FRR presentation.

Mission Planner challenge: Judges will provide special instructions for a mock mission to be programmed using Mission Planner software.

The highest scoring teams from the preliminaries will be invited to advance to the championship competition.

CHAMPIONSHIP FINALS

Results of the preliminary competition will be relayed shortly after the conclusion of preliminaries.

The championship competition takes place over the course of three days at AirVenture in Oshkosh Wisconsin, graciously hosted by the Experimental Aircraft Association. Weekly admission and camping on site is provided at no charge to UAS4STEM teams (this includes the students and up to five accompanying adults).

The main difference between the championship and the preliminaries is that there are no virtual components. Students deliver the FRR in person and fly the mission on site. Details are provided in the rule book.

There are no additional fees collected by UAS4STEM to compete in the championship competition. Teams are responsible for any associated travel costs.

This challenge is great for many different groups. This team formed from both a Civil Air Patrol unit and a Scouting troop.

UAS4STEM Technical Director Archie Stafford.

A team presenting their FRR for judging staff.

Students enjoying donuts on the final morning at AirVenture.

DRONE SPECIFICATIONS

- Quadcopter configuration (4 motors)
- 625mm maximum frame size (measured from one side of an arm to the other).
- Additional processors are allowed, but must cost less than $250 USD.
- Autopilot system must cost less than $600 USD Manufacture Suggested Retail Price (MSRP), including the Global Positioning System (GPS). This is a retail cost, meaning that even if a more expensive autopilot is donated, it is not allowed. It does not have to be a Pixhawk variant, but Pixhawk is recommended.
- Maximum of 8 channels. These include 4 for the motors, leaving four open to be utilized as the team sees fit
- Options include a camera gimbal, pickup, and drop mechanism controls
- If you use 2 for the gimbal, that leaves only 2 channels for pickup and drop mechanism(s)
- Maximum 4S 5200 battery size (any "C" rating) Batteries may be changed as often as necessary during the competition.
- Maximum propeller size 11".
- Up to a 1080p video camera. Camera Manufacturer's Suggested Retail Price (MSRP), must be less than $100 USD.
- Digital video is allowed. Camera and receiver Manufacturer's Suggested Retail Price (MSRP), must be less than $300 USD combined.
- Up to a 250mw video transmitter.
- Any antenna may be used for the video feed system.
- 2.4 Ghz RC control system. Any brand legal in the US
- One primary Ground Control Station (GCS) – Meaning only 1 laptop allowed on the flight line.
- Maximum of 2 video receivers allowed during the competition. One can attach directly to the GCS.
- Recommended telemetry radio RFD 900+.
- One additional sensor may be utilized. Sensor must be less than $50 USD MSRP.

CODE OF CONDUCT

The UAS4STEM Code of Conduct is designed to ensure that all participants contribute to a safe, respectful, and productive environment during all UAS4STEM activities. By participating in UAS4STEM, you acknowledge your understanding of these expectations and agree to follow the rules outlined below. Failure to follow the Code of Conduct may result in disciplinary or legal action to include removal from the event and/or future competitions.

1. UAS4STEM is a safe and respectful environment. Participants should act as positive role models, demonstrating leadership, and teamwork. Treat everyone with kindness and respect.
2. UAS4STEM has a zero-tolerance policy for any harassment or abuse. If you see something inappropriate or concerning, it is your responsibility to report it to UAS4STEM leadership and/or a trusted adult.
3. All participants should dress safely for the event. This includes, but is not limited to, wearing closed-toe shoes and other safety gear as required.
4. Treat all property, equipment, and personal belongings with care and respect.
5. The use of alcohol, drugs, e-cigarettes, or tobacco products is prohibited at any official UAS4STEM event activity.

EVENT GUIDELINES

1. UAS4STEM is a safe and respectful environment. All participants shall model appropriate behavior and lead by example. UAS4STEM has a zero-tolerance policy for any harassment or abuse.
2. If you witness or are the victim of harassment or abuse, immediately report it to a trusted adult and/or UAS4STEM staff. If you believe anyone is in immediate danger, contact law enforcement immediately.
3. Drugs, alcohol, e-cigarettes, and tobacco products are prohibited during official UAS4STEM event activities.
4. During official event activities, you consent to the use of any photographs, videos, or audio recordings of your participation for promotional or educational purposes by UAS4STEM staff.

AMA

UAS4STEM

DRONE ENGINEERING CHALLENGE

NOT YOUR TYPICAL FLIGHT CLUB

WATCH A VIDEO

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WWW.UAS4STEM.ORG